DOCUMENT RESUME

ED 348 212 SE 052 282

AUTHOR Maley, Donald, Ed.; Smith, Kenneth L., Ed.
TITLE Aerospace Resources for Science and Technology Education.
INSTITUTION International Technology Education Association, Reston, VA.
PUB DATE Mar 91
NOTE 83p.; This publication is a special edition prepared for presentation at the Meeting of the International Technology Education Association (Salt Lake City, UT, March 1991).
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052) -- Reports - Descriptive (141) -- Collected Works - General (020)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Aerospace Education; College Science; Community Colleges; Curriculum Development; Curriculum Evaluation; Elementary School Science; Elementary Secondary Education; Higher Education; *Interdisciplinary Approach; Program Descriptions; *Resource Materials; Robotics; Satellites (Aerospace); Science Activities; *Science Curriculum; Science Education; *Science Instruction; Science Projects; Secondary School Science; Solar Energy
IDENTIFIERS Model Rocketry; Space Shuttle; *Technology Education

ABSTRACT

This publication on Aerospace Programs is a special edition of "Technology Education" featuring descriptions of 15 select aerospace education programs from diverse localities spanning the full range of instructional levels. Following introductory material, the monograph contains the following largely unedited program descriptions: (1) summaries of 16 elementary school science projects; (2) review of a high school technology education curriculum focusing on instructional strategies useful to interdisciplinary conceptual integration; (3) report of the middle school activities comprising a study unit on satellites; (4) outline of a hands-on, self-directed junior high school project on model rocketry; (5) description of an introductory program for technology within a district-wide industrial arts curriculum; (6) an examination of various career options encompassed within an aviation/aerospace high school course; (7) a high school report on space station simulations; (8) profile of the space applications involving activities included within a former high school industrial arts program; (9) outline of the organization and the educational objectives involved in Moonbase America, and the specific efforts underway at Copley High School, Ohio; (10) overview of cooperative activities included in a high school aerospace technology curriculum; (11) explanation of the 8-step problem-solving procedure utilized in a high school aerospace and technology program; 12) discussion of the central project concept to focus technological instruction and high school activities; (13) detailed review of the central concept as a practical approach to interdisciplinary high school education; (14) report on the objectives, mission plan, and classroom setup for a mock, space shuttle flight at a community college; and (15) narrative of the role of graduate students involving the development of the Hubble Telescope during a practicum in an industrial arts class. Contact addresses for each author are included. A resource guide by Rob Campbell for educational services and materials available from the National Aeronautics and Space Administration, organizations supporting aerospace activities, educational suppliers, and industry is included. (JJK)

ED348212

SE 052 282

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it

☐ Minor changes have been made to improve reproduction quality

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Judy Miller

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

AEROSPACE RESOURCES
for Science and Technology Education

Technology Education contributes to understandings and capabilities essential for effective citizenship in the 21st Century.

This document was directed and edited by:

Dr. Donald Maley
Professor Emeritus
University of Maryland
College Park, Maryland

Mr. Kenneth L. Smith
Curriculum Specialist-Resource Teacher
for Technology Education
Charles County Public Schools
LaPlata, Maryland

*INTERNATIONAL
TECHNOLOGY
EDUCATION
ASSOCIATION*

Table of Contents

Acknowledgements 2

Introduction 3
Dr. Donald Maley, Mr. Kenneth L. Smith

Perspective 4
Dr. Donald P. Lauda

Perspective 5
Mr. Frank C. Owens

Aerospace Programs

Aerospace Technology In The Elementary School 7
Terry Thode

Aerospace Technology In Charles County 10
Kenneth L. Smith

Satellites And Students, Today, Tomorrow, And Technology 16
Margaret Rutherford

Technology Education, Reach For The Sky 19
Bruce M. Burwell

A Time For Change 21
Jerry Morlan

Aviation/Aerospace, A Program In Technology Education 25
John Blair

Southview High School, A School With A Mission 27
Fred Dull and Roscoe Schlachter

Solar Energy And Robots in Space Operations 29
Dean Frame

Moonbase America 32
Carolyn Stoudt

Aerospace Education, Sauk Rapids High School 36
Curt Olson

Aerospace An Educational Catalyst 39
Jim Kyd

Mission Control To Lunar Base 43
Craig Adams and Pat Daugherty

The Central Project Model 45
Larry McHaney and Jerry Bernhardt

Shuttle Victoria 51
Bob Calhoun

Development Of The Hubble Telescope Project 54
Dr. Donald Maley

Directory of Authors 59

Aerospace Resources

Aerospace Education Research Document 60
Rob Campbell

Acknowledgements

The editors of this publication are appreciative of the many individuals who have contributed to it. Special recognition is extended to the authors of the aerospace programs described in this document. Appreciation is also extended to the following persons from the Goddard Space Flight Center at Greenbelt, Maryland. They include, Richard N. Crone and Elva Bailey who are Education Program Officers. Also, appreciation is given to Jane Riddle, Librarian at the Goddard Space Center. A note of special thanks is given to Frank C. Owens, Deputy Director-Education Affairs Division, NASA Headquarters, Washington, D.C. for his perspective commentary and Dr. Donald P. Lauda, President of the International Technology Education Association, for his contribution.

It is also important to mention the following persons who have played important roles in the development of this publication: Dr. Charles Beatty, University of Maryland, Dr. Kendall N. Starkweather, ITEA, Simone A. Legacy, University of Maryland, Cyndi Romeo, Charles County Public Schools, Judy Miller, ITEA.

A very special appreciation is given to Mr. Rob Campbell for his extensive effort to research and develop the aerospace resource section of this document.

Finally, the editors extend their appreciation to the International Technology Education Association for the opportunity to participate in the editing and direction of this publication.

Dr. Donald Maley

Mr. Kenneth L. Smith

Introduction

This publication on Aerospace Programs as a part of Technology Education is a special edition for presentation at the Salt Lake City Conference of the International Technology Education Association (March 1991).

The aerospace activities as conducted in this country and in many nations around the world, represent a broad range of human accomplishments with and through technology in practically every dimension. The aerospace efforts and accomplishments provide a superb example of interdisciplinary involvement that has had few parallels. They represent an excellent example of the integration of efforts, nationally and internationally, as well as the integration of practically all fields of knowledge toward a multi-dimensional goal. It is in fact another significant effort of the human's endless effort to probe the timeless secrets and seek answers to the endless questions that have challenged them from the beginning of time.

The aerospace effort has special significance and meaning for Technology Education. It embodies such central elements as communications, power, energy, manufacturing, transportation and bio-technology as espoused by the professionals in Technology Education. Aerospace Programs in Technology Education also provide outstanding examples of the integration of many disciplines, including mathematics, science, history, economics, social studies, communications, and geography. As students develop their units and projects associated with these disciplines, they probe into the world beyond. Each of these disciplines reaches a level of understanding as students carry out their educational programs through good setting, designing, constructing, problem-solving, inquiring, communicating, leading, following, testing and analyzing and decision-making.

The programs presented in this publication are examples of what teachers in Technology Education are doing. The material is presented in most instances with little or no editorial modificaiton. They come from the various levels of education including elementary, middle or junior high school, secondary and higher education. The programs also come from a broad area of geographical representation.

The programs presented were submitted as a result of a nation-wide request for program descriptions by the editors. It is intended to be a sharing effort wherein professionals in Technology Education and other areas of the educational system may learn and benefit from each other.

Dr. Donald Maley

Mr. Kenneth L. Smith

INTERNATIONAL
TECHNOLOGY
EDUCATION
ASSOCIATION

Dear Colleague,

The International Education Association is pleased to provide this resource guide to assist teachers with aerospace activities. While it cannot cover virtually every resource available, we feel that it will provide teachers with a "head start" as they select content and instructional strategies.

The topic of aerospace provides an enormous opportunity to introduce students to many new concepts which have a direct bearing on their future. All of us have been impacted by the quest to comprehend and utilize the opportunities inherent beyond the Earth's atmosphere. And, we are just beginning to tap this vast resource. Today's child will witness events that go beyond today's technology, and in many cases, beyond our wildest imagination. It is our task and obligation as educators to help students comprehend rather than be mere spectators in these new realities.

It is our hope that this resource guide will assist you and your students by bringing you new information and challenging you. There is not a single discipline that cannot be enriched by the potential in aerospace knowledge and activities. This is especially true of Technology Education which is designed to help students comprehend transportation, communication and production systems. So use this guide to your advantage and capitalize on the content and motivation inherent in aerospace education.

The editors of this document are to be commended for their fine contribution and forward looking product. We hope that you, as a reader, will consider this just a beginning and offer your ideas and resources for others to use.

On behalf of the Board of Directors of ITEA, I wish you the best as you challenge your students, as well as yourself, in this important endeavor.

Sincerely,

DLauda

Donald P. Lauda
President

1914 ASSOCIATION DRIVE, RESTON, VA 22091-1502 (703) 860-2100

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

Dear Colleague:

NASA is proud to be supportive of aerospace education and activities that assist the technology teacher. Aerospace education is an important and exciting experience for students curious about their future.

As the world becomes more technologically sophisticated, students must be prepared to face new intellectual challenges. Technology education, integrated with traditional mathematics and science curricula, is the key to this future.

Education, and technology education specifically, is an important part of NASA's mission. NASA's educational strategy is closely aligned with the National Education Goals established by the President and the nation's governors. Our educational programs strive to ready the nation for the 21st century by enhancing the knowledge, skills, and experiences of educators; capturing the interest of students in science, mathematics, and technology subjects; and channeling students into science, engineering, and technology career paths.

Technology education and the space program are intrinsically linked. Today's generation of students knows that human beings can reach the moon. They can imagine space stations in Earth orbit and manned lunar and Martian outposts. The space program is the arena in which students' limitless imaginations can be unleashed. Technology education gives them the tools to realize their dreams.

Sincerely,

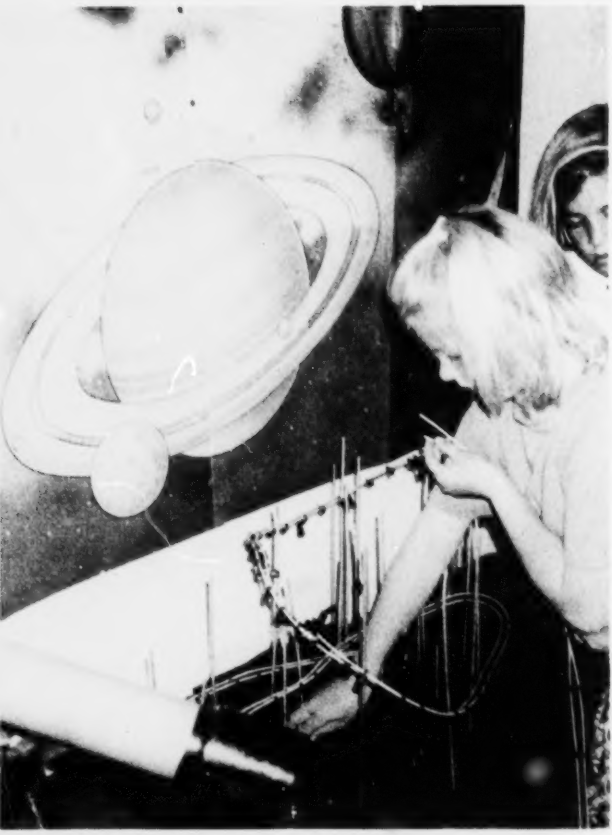
Frank C Owens

Frank C. Owens
Deputy Director
Educational Affairs Division

Aerospace Technology in the Elementary School

◆

by Terry Thode



Students Using an Acceleration and Momentum Track

Aerospace Technology activities are especially exciting to elementary school children who are eager to learn anything and everything about space and space-related concepts. Elementary students are extremely curious about how their world works, and virtually fearless when it comes to trying new ideas and technologies.

Technology Education is an excellent curricula area for delivering this type of instruction. Technology Education cannot begin to soon. For students facing a highly technological advanced society, it seems imperative that technological literacy begin as soon as possible. The following presentation is a discussion of one approach to Technology Education through aerospace education for the elementary school student.

The importance of preparing students to be competitive in a technology- based society is a major educational goal that should be started at the elementary level. Presenting the information and ideas in a hands-on, minds-on, problem solving environment encourages self-learning and provides the students with strategies to find solutions to real world problems. The students can then apply math concepts, science, language arts, geography, reading, etc. and use the tools of technology to solve practical problems related to aerospace technology and other areas.

Areas of high interest in elementary aerospace technology involve the exploration and implementation of computers, lasers, robotics, communications, and other advanced technologies.

Below are specific descriptions of aerospace instructional activities that have generated tremendous enthusiasm for learning by teachers and students. Also demonstrated is the significant value for these activities to provide realistic content integration.

- The fourth graders link up to the NASA SpaceLink database via modem to gain up-to-date information on Hubble and the Ulysses sun probe.

They print pertinent information and also leave a question for NASA to answer. Other students access local electronic bulletin boards and share ideas relating to space.

- Fifth graders are constructing bottle rockets from 2-liter bottles to launch following a presentation from a local physicist on gravity and thrust. They will use pneumatic power to launch the rockets and will ascertain the rocket height using clinometers (astrolabes) and trigonometric ratios. Other students elect to build robot models from kits to launch using solid-fuel rocket engines.
- Younger students attempt to propel a balloon across a string using air or water. They explore the difference between the force made by round versus long balloons, and what compression means.
- All grade levels are designing and constructing model space stations. Older students are learning scale and using CAD programs to design and produce a detailed drawing of their space station design.
- Students are accessing the CD-Rom computer encyclopedia for current information on shuttles, rockets and missiles to use in a database.
- Students are manipulating robots through simple pick-and-place maneuvers to simulate what astronauts do while inside the shuttle. The students also program the robots that are interfaced to the computer.
- Geography classes are locating telecommunication satellites in the Clarke Belt using the satellite dish and discussing how satellite communication works. They set up simulations of how satellites can locate lost or missing persons through signals. They also use computer software to map the earth from different distances above the earth and at various latitudes and longitudes.
- Third graders prepare a space menu. Then they use computer software to see if their meal contains the required nutrients. Graphs are created to show results. They then test actual space food for tastes, appearance, etc. and rate each one.
- Students set up an acceleration track to simulate the acceleration needed by a rocket and the subsequent speed needed by a satellite to reach and maintain an orbit. Building a roller coaster track is accomplished to help the students learn about acceleration and momentum firsthand.
- First, second and third graders explore Bernoulli's principle using the wind tunnel or a hair dryer. They test different shapes and discover what happens as air pressure is reduced around a surface. They then build gliders, kites, and airplanes to test the principles of flight.
- Fourth, fifth and sixth graders design and construct an airfoil to test in the wind tunnel for maximum lift. They decide whether their airfoils are aerodynamic and how to change/modify original designs to increase lift and reduce drag.
- Students script a weekly video presentation called "Space Stuff." They include information on the planets, the stars, any launches and the environmental impact of technology on the earth as a planet.

Launching a Rocket

Student Testing an Airfoil in a Wind Tunnel

- Second graders are using a laser reflection system to simulate how a laser works and how its beam can be used to locate objects in space. Older students use a laser to send a voice communication.
- As a follow-up for an art class, the students make murals depicting environments on other planets. Some students elect to make a scale model of the solar system or create star maps.
- Students are also becoming more aware of how life in space differs from life on earth. They are exploring gravity and learning that in space, little gravity and no atmospheric pressure strongly effect the way the human body functions.
- All grades are experimenting with the NASA tomato seeds; some are following the experimental set-up provided by NASA, others are making up their own experiments and hypotheses.

These are just a few of the aerospace technology activities currently explored at Hemingway Elementary School. To the elementary student, there are no limits to the imagination. Technology Education provides the environment where learning about aerospace and other areas is "fun" because it is hands-on, it introduces and explores new technology, it is relevant to what is happening in the real world, and it begins to prepare our young students for the highly technological future they must eventually face.

Terry Thode is a Technology Teacher at Hemingway Elementary School, Ketchum, ID.

Bottle Rockets Ready for Launch!

Robot, Being Used for a "Pick and Place" Maneuver

BEST COPY AVAILABLE

Technology Education in Charles County, Maryland

Aerospace Technology

◆

by Kenneth L. Smith

It appears there are many ways to introduce students at the middle school level to Aerospace Technologies. In fact, because the subject seems to be naturally interesting to the adolescent population, motivating middle school students to become involved in instructional activities related to this subject is quite easy. I know that I was fascinated with the early Mercury and Gemini programs and space travel in general when I was 13 or 14. I distinctly remember the photographs in *Life* magazine and similar publications. I just could not get enough of this outer space.. beyond our planet concept. It just seemed like "magic"... not technology, provided the means for humankind to accomplish those early feats in space. Well, that "magic" is still alive thirty years later. My students are still fascinated with this outer space "stuff." But, there is something available today that was not readily available for me. We now have Technology Education programs and teachers to help students discover the "how and why" part of this magic. We now have teachers who can assist these young students as they try to realize that this "magic" is just another demonstration of human ingenuity to solve "out of this world" problems. The "stuff" that is created to produce the magic just happens to be called Aerospace Technology.

This discussion is to present another way to approach the teaching of Aerospace Technology in a Technology Education program for the middle school. The program features team teaching, a student centered curriculum—teacher guided learning and multi-sensory, content integrating, and first handed, active—not passive involvement by students.

It is important to realize that the Technology Education program at John Hanson is comprehensive in scope. We allow students to select technological topics to study. This selection is based on their interests and curiosities. Of course, the instructors provide guidelines and suggestions when necessary. However, most students know exactly what they are interested in pursuing in this class. Aerospace Technologies are only part of the broad range of topic areas available for students to investigate. We use six broad content areas to guide students in their topic selections. These are: communications, construction, manufacturing, power-energy, transportation, and bio-technology. There are numerous introductory materials that are used to assist students as they begin thinking about their technological interests and curiosities. These include ... slides, movies, videotapes, models, field trips, textbooks, guest speakers, etc. Depending on availability, combinations of these are used to establish a foundation for each student selecting a specific technological topic for study. It just so happens that Aerospace Technology is usually one area that generates significant interest and a wide range of specific topics. These aerospace topics cut across all six of the broad content areas. To illustrate, topics can include:

Communications Satellites, optics, lasers, radio transmitters-receivers, radar

Construction Space stations, space structures, planetary structures

Manufacturing Weightless production of materials, planetary mining and material processing, vacuum environment production, laser welding-drilling

Power-Energy Solar energy, nuclear power, rocket engines, energy conversions. batteries, photocells, generators, Goddard's rocket

Transportation Space shuttle, probes, lunar vehicle, single astronaut propulsion system (jet pack), SST, (test vehicles-(X-15), (Bell X-1))

Bio-Technology Food production in space, bio-spheres, pharmaceutical engineering in space, space environmental design, robots, androids, life support systems, astronaut clothing-food

It is very important to point out that the evolutionary aspect of Aerospace Technology is extremely significant. Many view Aerospace Technology as a recent phenomenon. Certainly, it is true that our most dramatic creations have occurred during the past 30 years. But it is important that students and teachers realize that there have been many significant events and discoveries which have enabled humans to benefit from the Aerospace Technology that exists today. It is this anthropological component that must be included

This Display Contains Information on Function, Social Impacts, Evolution and Drawings

Saturn V Rocket From Early Apollo Program (1960's, 1970's)

"Special Education" Student With Shuttle Model

in a comprehensive Technology Education program. Goddard's early experiments with liquid fuel rockets were certainly paramount to the development of the sophisticated rockets used throughout the space program of the last 20 years. So, it is not unusual to find our students investigating anthropological as well as contemporary Aerospace Technologies in this program.

Instructional Strategies

After each student has selected a significant technological achievement to investigate (included are many Aerospace Technologies), they will begin involvement in the following activities:

- Conduct an independent research effort
- Design and construct a detailed model of selected topic
- Prepare written and oral presentations on topic
- Design and construct an informative display

Participate in program promotional activities such as . . .

- Open House night
- Video production on "Aerospace Technology"
- Presentations to other classes (including elementary schools)
- Slide show production on "Aerospace Technology"

Below is a description of these strategies.

Conduct Independent Research

Each student is responsible for obtaining appropriate and relevant information about their topic. Instruction is provided to assist students as they seek sources of information. Library time is scheduled with very specific worksheets to keep students on task. There are numerous reference books available in the classroom library. One unique feature of our program is the availability of student created instructional resources. Each year as students complete their research, we collect this valuable information and using a specific format, have students create their own learning packet. These packets are labeled and stored in filing cabinets in the classroom. These packets can then be used as starting points for new students each year. This effort significantly increases the amount of useable information for many topics, particularly Aerospace Technologies. Related to this activity, students also contribute to a program "address book." This book contains addresses for sources of information by topic. If a student is investigating the space shuttle, they will simply look up their topic and find many sources of information identified. The address book also grows each year as students make their informational contributions.

We do not limit our students' research efforts to resources within the school. Students are responsible for preparing correct business letters requesting information and assistance in their research. These letters are mailed and the waiting begins. You can not imagine the excitement created when responses to their letters begin to arrive. This excitement generates a storm of enthusiasm to produce additional letters. The acquisition of information can be overwhelming, as a result, the selection and editing of information is controlled through the use of specific questions provided by the instructors. These questions supply the direction needed by our students as they attempt to read and select relevant data related to their topic. Class seminars are scheduled which provide students the opportunity to share their progress as they pursue their search for information.

Design and Construct a Detailed Model of Topic

One of the first items each student is responsible for obtaining during their research are pictures of their topic. These pictures are used to begin the planning-design of the model they will build. At this point in the program, students are introduced to drafting-design techniques. This activity includes traditional drafting-design methods . . . drawing boards, T-squares, triangles, rulers as well as computer design techniques (CADD). Student complete a set of plans which will guide their construction of a detailed model of their topic. After appropriate safety and machine instruction, students are permitted to fabricate the necessary parts for their model. This laboratory activity usually generates the most excitement for our students. The student project has always been one of the strongest qualities unique to our field. This construction activity usually lasts for many months. During this time, students are constantly being challenged through . . . problem solving, decision making, critical thinking, cooperating, analyzing, selecting, as they interact with numerous tools, materials, machines, processes, instruction is provided as needed. It is not unusual to find one-on-one instruction, small groups, or when necessary, the entire class involved. Peer instruction is also widely used. As students develop outstanding skills with tools, machines, and processes, they are asked to assist in the instructional process. This contributes to the development of strong self concepts and helps the teacher with the tremendous instructional workload. It is important to point out that the model is not the focus of the program. The model is a means to an end. True, the model is extremely important to the student. It is because of this intense student value given to the model that the program is successful. The student chooses a topic based on his/her own interest-curiosity. Each student is excited about their model. This unique quality generates the momentum required to sustain the student's desire to accomplish so much more.

Prepare Written and Oral Presentations

Our program offers an excellent opportunity for students to improve their communication skills. All teachers have witnessed the willingness of students to write or talk about topics that are interesting to them. This program starts with students choosing technological topics of personal interest. The intense fascination with Aerospace Technology provides even more fuel for willing communication by middle school children.

Once again, specific questions are provided by the instructors to guide students in the preparation of their written and oral presentations. The written reports are used in the "student created learning packets," which are stored in the classroom. The letter writing campaign is another important communication activity for our students. This is usually the first real-world attempt for these young students to request information from someone very far away. To receive a response from their letters completes the communication process for them in a very "real" way. It's not pretend, it's real. These written reports are completed using the personal computers in the laboratory. Using the PC seems to create excitement about writing. Middle school students simply enjoy using the computer. It makes writing . . . fun. These written reports are also used on the informative displays that each student will have to create. The display becomes another effort at effective communication. Using pictures, drawings, written reports, graphs, each student must present a clear, accurate message about their topic.

Oral communication skills are also reinforced. Class seminars are planned and conducted to provide students the

Helium—Weather Balloon—"High Altitude"

14

opportunity to address specific questions related to their topic. These seminars can take on many forms . . . some address progress related to the design and construction of their model. During these meetings, students will discuss specific problems or successes associated with the fabrication of their models. Students are encouraged to offer suggestions to each other regarding tool, machine, material or process selection for a particular construction problem. Other seminars are related to the research effort by each student . . . providing the opportunity to share information about their chosen topic. These meetings are usually formal with specific schedules and guided by a student seminar leader. The teachers role is to evaluate and guide when appropriate. A final strategy for communication involves the students in the creation of a slide-show or video which showcases each student's model and display. Once again, this activity is very enjoyable for middle school students and produces some very useful materials which the teachers can use for program promotion. Students are responsible for writing-planning-producing the video. Role playing becomes an effective strategy for organizing and directing this endeavor. The entire process is controlled by the students. Sure, the teacher guides—makes suggestions—oversees, but the final product truly belongs to the kids. Their imaginations will amaze you. Just let them go to it! Besides they are already excited about their aerospace topics!

Integrating Mathematics, Science, and History

I have already discussed the value of this program for integrating communication skills for middle school students. But also available is the opportunity for the integration of mathematics, science, history, and geography. Once again, because the student is involved with a topic of his/her own choice, activities are planned to capitalize on this inherent motivation to learn. A golden opportunity exists to understand basic science and mathematical principles related to each topic. In addition, there is the advantage of realizing a sense of history through technological achievement in this program.

The seminar becomes the instructional strategy through which the integration can occur. Two seminars are planned and scheduled to address the inclusion of science-mathematical principles and a historical perspective of each students topic.

X-15 Model and Display

The first seminar, **"Function Of Your Technology Topic,"** challenges students to answer questions related to function such as . . .

- What does your topic do?
- Identify all major parts.
- Explain how each part works.
- Identify the basic scientific principle which causes each part to function.
- Does this technology have a power system? . . . if so, explain.
- Prepare visuals to help explain each scientific principle.

This program can provide the one place in the school where the student can make sense out of mathematics and science. Suddenly, vague and often meaningless principles have a real-world purpose or application. I must point out that answers to these questions do not just appear. There are many worksheets, resource materials and related science and math textbooks—including math and science teachers that are utilized to help our students truly understand the "magic" that causes their particular technologies to function.

The second seminar, **"Evolution of Technology,"** addresses the issue of technological change and it's effect on society and the environment. Each student will discuss the overall importance of their topic to humankind. Questions, such as the following, are discussed:

- Identify the date your topic was created (time period).
- Create a time-line which depicts the relative place of creation and use for your topic historically.
- Identify the positive impacts of your topic for society and the environment.
- Identify the negative impacts of your topic for society and the environment.

Once again, "time-line" and "impact" worksheets are provided which guide the students as they address these questions. It is also not uncommon to find our school's social studies—history teachers joining in and assisting our students as they prepare their answers. In fact, one of our social studies teachers, Mr. Jim Newbold, regularly attempts to purchase many of the student models. These models are used to generate excitement about his subject—History. He uses the natural technological curiosity that these young students possess to present historical knowledge. Content integration? You bet!

These two seminars allow students to exchange information about their topics. Actually, each student becomes an authority on his/her topic. As the exchange takes place during the seminar meetings, students learn a great deal from each other. The roles of the teacher and student have been redefined. The teacher no longer holds the position of being the source of all information. The student is held responsible for his/her learning. We, as teachers, manage the educational process, allowing students to experience not only the task of "learning" but also accepting the task of "teaching" others about their topic.

Accommodating Different Student Levels

One very significant feature of our program is that it allows for individual differences in student levels. The degree of sophistication and quantity of information processed by each student varies substantially. But the ability level of the student should not diminish the overall value of such a program. This program can work for all students. It becomes the teachers responsibility to manage the teaching-learning strategies to meet the needs of each individual. I would suggest that two things need to occur for any student to experience success in this program:

- The student studies a topic that is of interest to him/her.
- The teacher manages teaching-learning processes with respect to the level of each student.

When these two criteria are met . . . children learn.

Summary

Once again, Technology Education demonstrates it's tremendous potential as the one place in the school where the student can *put it all together!* It is a program that truly prepares young people for the demanding—highly technological society they will inherit. It

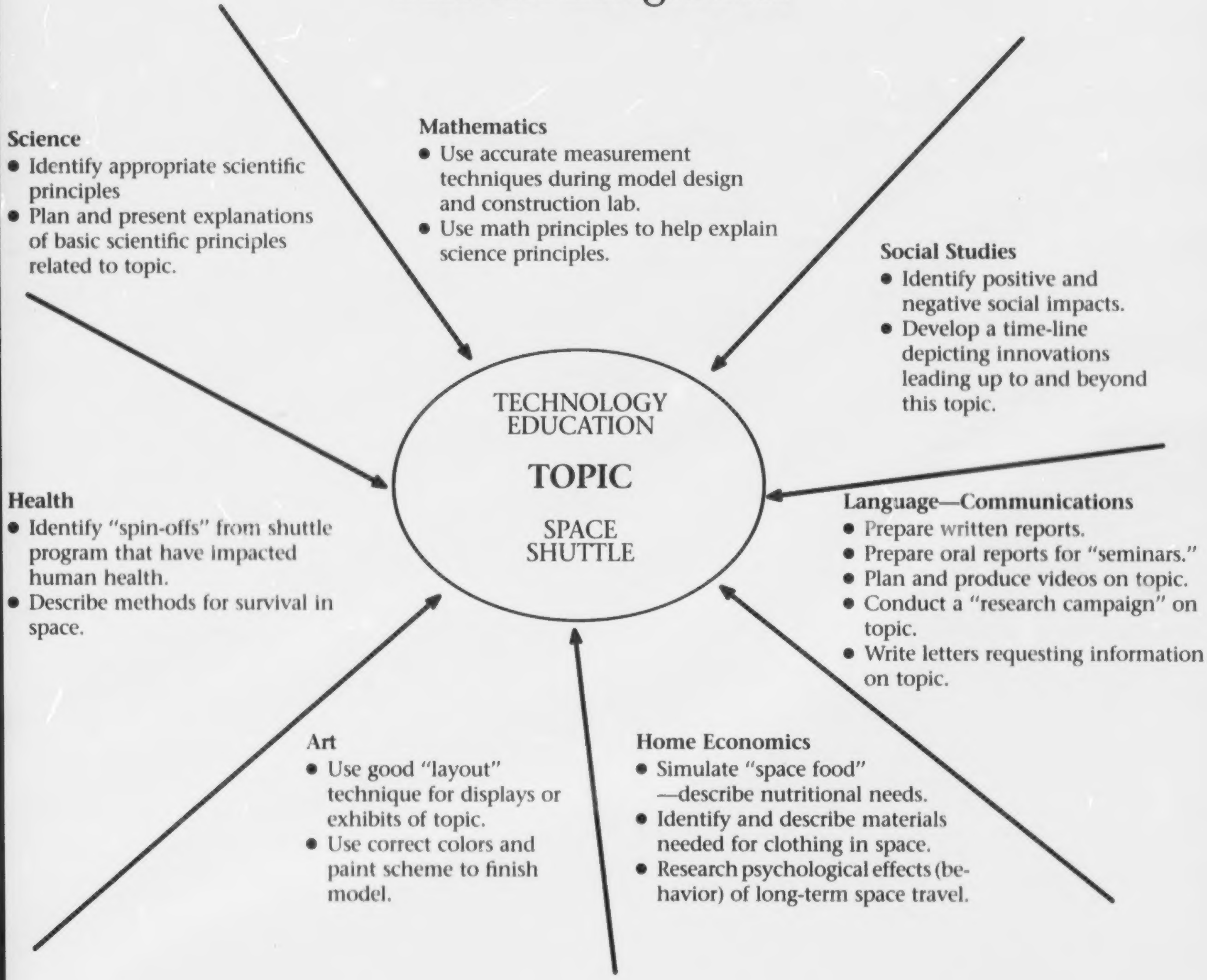
Technology Topic	Science Concept	Math Concept
Space Shuttle	Newton's Law of Motion Bernoulli's Principle Aerodynamics Thrust	$F=M \times A$ Order of Operations $\text{Power} = \frac{\text{Weight} \times \text{Dist.}}{\text{Time}}$
Satellite	Geosynchronous Orbit Energy Conversion Frequency Wavelength Reflection	$F=\frac{GMM}{r}$ $C=2 \times R$ Focal Point Parabola $Y=Ax + Bx + C$
Radar	Doppler Effect Frequency Wavelength Echo-Reflection	$D=\frac{\text{Time} \times \text{Rate}}{2}$ Decimals Order of Operations
X-15	Thrust Bernoulli's Principle Speed-Acceleration Kinetic Molecular Theory	Measurement Decimals $S=\frac{D}{T}$
Goddard's Rocket	Thrust Chemical Reactions Acceleration Gravity	Ratios $F=M \times A$ $A=\frac{\text{Velocity}}{\text{Time}}$ $P=\frac{\text{Force}}{\text{Area}}$
Wind Tunnel	Bernoulli's Principle Drag-Lift Wind Energy Friction Pressure	Order of Operations Decimals Measurement Graphs Scale
Space Station	Weight-Gravity Force Orbit Energy Conversion Radiation Solar Energy Food	$F=M+A$ Measurement Ellipse Shapes
Hubble Telescope	Light Energy Refraction Distance Magnification	Angles Angular Measurement Measurement Exponents
Space Suite	Radiation Heat-Cold Respiration Bio-Technical Engineering Mechanical Advantage	Measurement Fahrenheit-Celsius

can also be an experience that focuses on the individual. It's not so much the "topics" selected, as the "learning to learn" process which is experienced, that is so worthwhile. The use of "Aerospace Technology" is just a part of the broad scope of a relevant technology education program. It just so happens that middle school students continue to be fascinated with the "magic" of space exploration, just as I was in the early 60's. This fascination can become the prime motivator for young students wanting to know more about their world and beyond!

The following chart demonstrates basic science and math principles related to specific "Aerospace Topics" for the middle school.

Kenneth L. Smith is a Curriculum Specialist Resource Teacher of Technology Education at Charles County Public Schools, La Plata, MD.

Aerospace "Content Integration"



Science
- Identify appropriate scientific principles
- Plan and present explanations of basic scientific principles related to topic.

Mathematics
- Use accurate measurement techniques during model design and construction lab.
- Use math principles to help explain science principles.

Social Studies
- Identify positive and negative social impacts.
- Develop a time-line depicting innovations leading up to and beyond this topic.

TECHNOLOGY EDUCATION

TOPIC

SPACE SHUTTLE

Health
- Identify "spin-offs" from shuttle program that have impacted human health.
- Describe methods for survival in space.

Language—Communications
- Prepare written reports.
- Prepare oral reports for "seminars."
- Plan and produce videos on topic.
- Conduct a "research campaign" on topic.
- Write letters requesting information on topic.

Art
- Use good "layout" technique for displays or exhibits of topic.
- Use correct colors and paint scheme to finish model.

Home Economics
- Simulate "space food" —describe nutritional needs.
- Identify and describe materials needed for clothing in space.
- Research psychological effects (behavior) of long-term space travel.

Satellites and Students

Today, Tomorrow, and Technology

◆

by Margaret A. Rutherford

Students on a Tour of Dupont, Learning how CAD Systems are Used

Throughout the United States and many other countries, the nineties began a decade of teaching where new technologies are incorporated into teaching—and new technologies are taught. Classroom teachers are using a vocabulary of educational terminology including "the systems approach" and an "interdisciplinary approach." The new technologies have teachers reexamining existing and innovative approaches to teaching technology.

Surfacing from the search for new ideas and methodologies appears an exceedingly fascinating subject of study: Space Technology. Emerging from the myriad of topics found within this new subject is the topic of satellites.

A unit of study around satellites can be incorporated in an interdisciplinary approach to the instruction of many of the technologies. Communication, energy, power, transportation, and production technology can all be included. The types of technologies included can be at the discretion of the instructor based on the essential elements of the curriculum.

Preparation for a unit study on satellites should begin by collecting information. NASA supplies numerous pamphlets, posters, and videotapes dealing with satellites. Communication industries, radio and television stations can provide information. Technology oriented magazines and newspapers are a current source of information. Libraries and book stores are a source of books, magazines, and newspapers covering the topic. Regional educational service centers have videotapes about satellites. If possible, try to arrange for tours of satellite related businesses and industries. Arrange for a satellite video conference. Invite persons who are in satellite related jobs to be guest speakers.

After researching the topic and collecting information, transform the lab into a satellite production lab. Have the students participate in the preparation of the lab. Cover the walls with posters and banners. Hang models of satellites. Suspend a model of the sun and planets orbiting the sun. Be creative, use your imagination, let your students use their imaginations!

Covering the basic information about satellites can be managed in a number of ways. The teacher can lecture, show videotapes, and/or have students study literature on the topic. Students can research satellites in the library, watch videotapes as teams, and interview individuals from industry who in some way are impacted by or use satellites as a part of their job. Invite guest speakers and videotape them so that all students can benefit. Take students on a tour of radio, television, or a weather station so they can learn, first hand, how satellites are used. If field trips are not possible, the instructor can ask if the industry involved has or can prepare a videotape of a tour.

Every effort should be made to have students realize the numerous ways satellite technology is used. Below are some examples:

Satellite Applications

- Communications
- Weather Forecasting
- Cartography
- Military
- Agriculture
- Forestry
- Oceanography
- Pollution Detection
- Wildlife Study
- Space Exploration

Information on satellites should include history, types, uses, benefits, and methods of launch. It is important to introduce social, economic, and environmental impacts involved in the manufacture, deployment, operation, and maintenance of satellites. Space pollution is just as important as earth pollution. Engage students in discussions and/or debates on the problem of space pollution created by the rocket launches and deterioration of satellites.

After the students have been given instruction and have investigated types and uses of satellites, have them individually or in teams, design and submit sketches of a satellite of their choice. Have each team choose a name and design a logo for their satellite manufacturing company. They are to either follow a report format generated by the teacher, or fill out a teacher-made packet designed to collect and synthesize information.

WEATHERCENTER 25
25

Students Learn About the Use of Satellites in Weather Forecasting

Students with Completed Satellites made with Recyclable Materials

Emphasizing the need to save our resources, require the students to construct the satellites using at least 50% to 75% recyclable materials. Have students go on scavenger hunts to find materials that can be utilized in the construction of the satellite.

Students can use parts of toys, styrofoam, cardboard, cans, boxes, wire, tubes, plastic bottles laminated foil, model lumber, bottoms of plastic bottles, lids, balls, net-like materials, bottle caps, etc to construct the satellite. The satellite model assembly should include a body for instruments, computers, rocket motors and a fuel source, solar panels, antennas, and sensors.

Upon completion of their models and research, videotape student presentations of the satellites. Also, have the teams or each individual, turn in a report in which the following are included:

1. Computer generated cover sheet with sketch or CAD drawing of the satellite.
2. Type of satellite and how it will be used.
3. Method of launch of the satellite.
4. Types of fuel for launch and maintenance of orbit of satellite.

5. Type of orbit of satellite.
6. Names of similar satellites and who launches them.
7. Social, economic, and environmental impacts of the satellite.
8. Life expectancy of satellite.
9. Actual cost of similar satellite.
10. List of recyclable materials used in model satellite construction and a bill of materials for any purchased items and those supplied by the instructor.
11. Bibliography.

Send out computer generated invitations to parents, public officials, teachers, administrators, board members, and the news media. Plan for the open house. Have the class identify their satellites and display their reports. Also included in the open house should be professional journals, technology related magazines, texts, library books, newspaper articles, curriculum guides, and any other materials used in teaching this unit. The open house is an excellent time to advertize your program. Make sure you have personally invited the news media. Dress for the occasion. A nice appearance by students and teacher is very important to the program image.

During the open house address the visitors. Explain Technology Education in general, its scope and sequence. Give a brief overview of the process involved in launching the study of satellites. Entertain questions from the visitors. At this time, show the videotape made of students presenting the satellites. After this, allow parents to informally tour the lab with students acting as guides.

We must acknowledge our role as leaders in the educational process. Technology educators offer the opportunity to teach the applications of science and math. Our approaches to teaching must be interdisciplinary, innovative, and experiential. Whether we use a study of satellites, aerospace planes, or space stations as the vehicle, the approach is critical. We must teach to a populace who will encounter a multi-cultural-highly competitive, global village where technology plays a critical role.

Margaret Rutherford is a Technology Education Teacher at Howell Intermediate School, Goliad, TX.

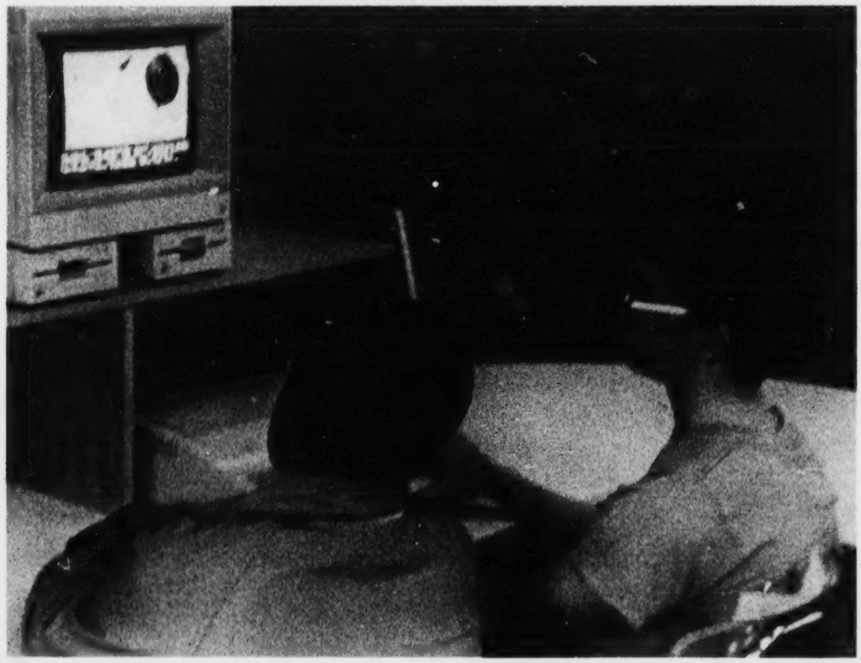
20

Technology Education Reach for the Sky

◆

by Bruce M. Burwell, Sr.

Students use the Computer to Build Understanding of Rockets and Space Matters



Students enrolled in the 21st Century Technology Education Laboratory at Crestwood Junior High School in Chesapeake, Virginia were provided the opportunity to expand their learning in space technology. Model rockets provided this versatile, "hands on," learning experience for these students.

Model rocketry existed as a viable tool in that the students learn the concepts involved in the construction and the flight of their rockets. The laws of motion and other scientific principles used in full-sized rockets are replicated in the student's projects.

The length of this activity was one week, or five 50 minute class periods. The program is presented to the students in the following manner:

Day One—Students viewed the "Flight and Space" video to acquire needed background information.

Day Two—Students utilized the computer programs "In Search of Space" and "Aerodynamics of Model Rockets"

Day Three and Four—The students assembled their rocket kits. Test flights and assembly adjustments were made. The class was divided into teams with different responsibilities (Trackers, Preparation Team, Safety Officers, Launch Director, etc.).

Day Five—If all conditions (wind/weather) permitted, the students performed their assigned duties and launched all rockets. Launch procedures and safety were taught and stressed in days three, four and five.

One of the assets of this program unique to Crestwood, was the students' ability to use computer hardware and software. The following is a listing of the hardware and software that has been useful for the projects:

Hardware

- Apple II gs Computers
- 5.25 disk drive
- A color monitor for best use of the color graphics.

BEST COPY AVAILABLE

Student Prepares Rocket for Launching

Software used

- In Search of Space (Introduction to Model Rocketry)
  The menu includes:
  -Model Rocket Flight Profile
  -Parts of a Model Rocket
  -Model Rocket Engines
  -Model Rocket Engine Classification
  -Model Rocket Safety Code
  -Tech Tip

These programs introduced students to the exciting world of model rocketry. Students learned about model rockets and how they are built.

- Flight:Aerodynamics of Model Rockets
  The menu includes:
  -Introduction
  -Forces on Flying Objects
  -Aerodynamics
  -Drag
  -Center of Gravity/Center of Pressure
  -Stability
  -Tech Tip

Each program contained well-organized information on its subject. Both programs featured excellent graphics to aid in the students' understanding.

Not only have the students learned aerospace terms, rocket propulsion, and the scientific principles governing the operation of model rockets but also many other life skills. The students have learned to follow directions, to practice social skills of working together in a group towards a common goal, to become safety conscious, and to gain a sense of responsibility for their efforts. Self-esteem built through the satisfaction of achievement was another fringe benefit of this unit.

This project is basically self-directed by the student under the supervision of the instructor. This activity not only is technically appealing, it also helps to build maturity, a sense of responsibility and pride, as well as high self-esteem.

References

Cannon, Robert L. and Michael D. Banks *The Rocket Book*. New York: Prentice Hall Press, 1985.

Cannon, Robert L. and Mike Dorffler *Flight: Aerogynamics of Model Rockets*. Penrose, Co: Estes Industries Inc., 1986.

Cannon, Robert L. and Mike Dorffler *Model Rocketry—The Space Age Teaching Aid*. Penrose, Co: Estes Industries Inc., 1987.

Smith, Harry T. and Henry J. Warden *Model Rocketry in Industrial Arts*. Penrose, Co: Estes Industries Inc., 1980.

Bruce M. Burwell, Sr. is a Technology Education Instructor at Crestwood Junior High School in Chesapeake, VA.

Clark County, Las Vegas, Nevada

A Time For Change

◆

by Jerry Morlan

The Clark County School District in Las Vegas, Nevada currently has 120,000 students attending nearly 150 schools. The district has a ten-year building plan that will result in 77 additional schools being added (13 new elementary schools opened during the 1990/1991 school year and 18 new schools are currently under construction including eight secondary schools). This building program has made it possible for the expansion of new programs within the school system. During the past three years, Industrial Arts teachers in the district have been working on the development of an "Introduction to Technology" program. The technology program will automatically be included in each of the eight new secondary schools.

The Introduction to Technology program at Garside JHS is being used as a prototype for the Clark County School District. The Clark County School District is currently supporting nine pilot programs within the Introduction to Technology area. Those include Garside JHS, Hyde Park JHS, Brown JHS, Cashman JHS, Kenny Guinn JHS, J.D. Smith JHS, Virgin Valley JHS/Senior HS, Burkholder JHS, and Vo Tobel JHS.

Introduction to Technology is currently being offered to some degree in 23 school sites within the State of Nevada. An on-going development program is being supported by the Nevada Department of Education, Occupational Education Branch in Carson City, Nevada.

Each school has been supported with Carl D. Perkins Federal Funds in the amount of $14,500. That money has been spent to purchase equipment and supplies to support the curriculum developed for the Introduction to Technology program. Pilot teachers have been attending regular monthly seminars on teaching techniques used in the technology field.

Early in the pilot program, teachers found that the traditional form of education delivery would not be sufficient in the teaching of technology. Because of the vast numbers of different types of equipment and supplies, storage of projects in progress, and the numbers of students involved, a new approach to the delivery had to be developed. The modules listed here are an indication of the types of technologies being taught. This list is not to be construed as complete or as being taught in all locations.

- Electricity
- Biotechnology Health
- Refrigeration/Air Conditioning
- Transportation/Rail/Flight/Automotive
- Pneumatics, Hydraulics, Electric Mechanisms, Automotive Electronics
- Computer-Numerical-Control (CNC)
- Aerodynamics/Space Technology
- Lasers
- Weather/Water Conservation
- Environmental Protection
- Biotechnology/Hydroponics
- Fiber Optics
- Computer-Assisted-Design (CAD)
- Desktop Publishing
- Robotics
- Satellite Communications
- Solar Energy
- Waste Management
- Power Conservation
- Electronic Communications
- Small Engines
- Architectural Structures

It was decided that a delivery system be developed that would allow for students to work in pairs on "modules." This would mean the 16 to 25 modules be developed that would take the students from seven to ten days to complete.

Over the past two years, teachers have worked to develop a new approach to the teaching of technologies usually found in the workplace. Because of a change from an industrialized nation to one of communication/information processing, they found it necessary to update the shop program by introducing modern methods, materials, and equipment.

Clark County teachers have sought assistance from a wide variety of local business, industry, and government agencies to assist in the development and acquisition of equipment and materials in the development of this program. Partnership programs have been instituted with the U.S. Department of Energy, Holmes & Narver, E.G.& G.

Robot Manipulation for Planetary-Space Work

Energy Measurements, Las Vegas Air-Conditioning Association, Las Vegas Valley Water District, Valley Bank of Nevada, Desert Research Institute, U.S. Department of Labor, Computerland, The Triad Group, The Home Office, and the Nevada Power Company. During the summer of 1990, the U.S. Environmental Protection Agency, Sandia National Laboratories, and Lockheed's Engineering & Sciences Company joined the partnership program.

The School/Community Technology Partnership Committee met monthly to assist teachers with the development of a district-wide technology plan. It was decided that the committee would provide the funding to establish one site as a prototype enabling other schools to experience equipment and methods prior to their purchasing such modules. Several partnership companies and/or governmental agencies provided Garside Junior High School with invaluable aid in the development of new teaching strategies, materials, equipment or money to purchase equipment. During the month of May, 1990 the U.S. Department of Energy gave a $55,000 grant to Garside JHS for the purpose of developing a model site. It was intended that this site would be used to enable other schools in the local district as well as from around the state to experience potential technology modules. This site is continuing to serve as a developmental center for new technology teaching modules.

The program at Garside Junior High School is typical of the pilot programs and has undergone major changes to reflect new technologies. This has meant the addition of many new computers and other pieces of equipment. The Clark County School District remodeled the traditional wood shop into a modern technology laboratory during the summer of 1990. That remodeling included modular learning stations, separation of the wood working equipment from the technology equipment, carpeting, a dropped ceiling and many other improvements.

The addition of technology to the curriculum at Garside has meant many changes to the school and Mr. Morlan, the instructor. As an instructor, Mr. Morlan has had to broaden his teaching scope to include many new areas. This has meant that students are now exposed to a much broader variety of learning experiences.

Students participate in a variety of projects which require that they design and then build a project. Students design, build, and test architectural structures in a specialized setting. They work with various design concepts to develop structures which must meet rugged testing procedures. They utilize the computer to design such things as model bridges, CO_2 powered cars and model rockets. Each of these projects reflects on a different form of technology which has a common thread of computer assisted design. A windtunnel has been added as part of the Aerodynamics program. This module includes automotive design, aircraft design and model rocketry as part of the study materials. Students design and construct models which are then tested in the windtunnel prior to actual flight.

Students learn what makes an airplane fly. Because airplanes are subject to atmospheric conditions, they also need to know how to make measurements of weather conditions and know how they affect an aircraft. They study the many careers related to Aerodynamics and the Aerospace industry. They learn about how engineers design, develop, test and help build aircraft, missiles, satellites, rockets, and spacecraft.

During their design assignment, they learn how to work with such things as how an airplane flies, airfoils, lift and weight, thrust and drag, and the laminar flow of air. During this process, they must be able to measure weather conditions with weather instruments. As part of this exercise, they measure wind speed, air temperature, air pressure, and relative humidity. Each student does an experiment with airfoils. They make corrections based on calculations of their airfoils. These tests are conducted in a windtunnel which simulates actual flight.

Mock Communications Satellite

A satellite receiving station has been added, giving students insights into the communications area of space technology. Students are exposed to the exciting world of satellite technology through the use of an actual working model satellite receiving dish that they can move outdoors for the purpose of receiving satellite signals. During this process they research the history of satellites, their method of working, their location above our planet, and their purposes. Included in this module are instructions on how satellites are constructed and operated.

E.G.& G. Energy Measurements, one of the school's partnership companies has provided the students with hands-on assistance with their satellite. In addition, the company has provided the students with field trips to view the company's laser, fiber optic and satellite systems. The students have had the opportunity to be exposed to NASA's mobile training program when their unit came to Garside for a one-day presentation of flight and spacecraft. Garside students and students from J.D. Smith Junior High School were taken on January 25, 1991 to TRW's Redondo Beach Space Center for a field trip. This trip was sponsored by TRW and the U.S. Department of Energy who supplied the bus transportation and had a special presentation by Dr. Lodewijk van den Berg, an Apollo Astronaut, who spoke on "My Experiences As An Astronaut."

Students are now being taught Computer-Assisted-Drafting (CAD) in addition to board drafting. Each student is paired up with a more experienced CAD operator and taken through a basic CAD design problem. Students are then quickly moved on to a practical assignment. They are encouraged to do a layout of one of the school's classrooms, or a floor plan of a home or business.

The addition of desktop publishing has made it possible for students to produce a technology class newsletter. There has been strong inter-disciplinary team teaching efforts with the English department in this endeavor. Technology students have been supporting the school newspaper with layout and printing of the master copy. Technology students have also produced class newsletters using articles written by English students. These newsletters were then supplied to local newspapers by the English teachers for publication.

Technology students are offering a service to the school's teachers by designing and printing certificates of merit. They design and then print them out on a laser printer, providing a master certificate specifically designed for a particular teacher's needs. That certificate is then sent to the school graphic arts department for printing.

A laser training module has been put into place. Students will be experiencing laser technology and how it affects the world in which we live. They are able to send sound across the laser beam to a receiver. With the addition of an oscilloscope, they are able to measure the speed of light. The study of fiber optics in communications is included in this module. A portable satellite dish with receiver and television set has been added to provide students with communications training involving long distance transmissions.

An automotive trainer has been added, enabling the students to learn about rack and pinion steering systems, suspension systems, hydraulic systems and drive trains. The students gain knowledge about basic automotive principals in this module.

Pneumatics, hydraulics, automotive electricity and electro-mechanisms trainers have been added to provide students with knowledge of the usage of air, electricity, and liquids to drive or operate machinery.

A solar energy trainer has been added to instruct students in the many valuable ways that this energy source can be harnessed by man as a inexpensive and non-polluting source of energy. In addition to this, students are working on a waste management module where they study the effects of waste and pollutants. This module includes a serious look at the question of nuclear energy, its uses, benefits, and waste disposal problems.

A health module which allows students to monitor basic body functions has been incorporated into the biotechnology module. A local dental office recently donated the funds to purchase hardware and software, which enables the students to make investigations and monitor such things as the body's brain waves (EEG), Electrocardiogram (EKG) and Electromyogram (EMG). This program enables the school's life science students to interface with the technology students in measurements and studies relating to biotechnology.

An electricity training module provides students with house wiring and wiring code experiences. Students learn about basic principals of AC and DC electricity. During this module they construct a "D" cell battery and practice on a house wiring circuit. This unit also includes an electronics training module which gives students insights into basic electronic principles.

Various stand-alone and computer-driven robots have been added, to train students about the growing areas of robotics. Students are required to program the computer to make basic manipulations typically used in today's industrial workplace. A model railroad that is computer driven is used to provide students with programming expertise and to expose them to an industry tool used for directing equipment.

A CNC metal lathe is being used to train students about modern machine technology. Students make a functional product which must meet rigid quality control requirements.

A radio programming module has been added to the communications area. Students are required to research subject matter, prepare scripts and record a simulated radio program utilizing the elements of narration, sound effects and music.

A small engines training module has been added which will allow students to study the internal workings of the combustion engine. Students will learn how to throughly service small gasoline engines.

The Introduction to Technology program is designed to provide the junior high school student with exploratory experiences that would enable him/her to make meaningful choices at the high school level as to class program selections. This would provide those students with the opportunity to select occupational choices early in their high school career that would align them with employment possibilities found in the work place. A strong emphasis is placed on the student gaining broad transferable skills along with a strong work ethic necessary in today's workplace.

As part of this program, it must be noted that these technologies are a natural articulation to the community college program for the technician oriented student or to the university for the professionally oriented student. A "Technology One" course is in the near future for the District's ninth and tenth grade students. This will provide the student with a potential six year technology program (two years for Introduction to Technology, two years for Technology One and two years for Principles of Technology).

The partnership committee is continuing to meet and modify the program. It is anticipated that additional modules will be developed during the 1990–1991 school year to further enhance this new program.

Students Developing Designs for Space Structures

PaxCOMM
SATELLITE COMMUNICATIONS
PAXTON PATTERSON
ILLINOIS

Setting up a Satellite Communications Dish

Jerry Morlan is a Technology Education Specialist at Frank Garside Junior High School, Las Vegas, NV.

A Program in Technology Education

Aviation/Aerospace

◆

by John Blair

Student Flies the ATC-510 Flight Simulator

Herndon High School, a Fairfax County, Virginia school, offers an aviation/aerospace course under the Technology Education umbrella. The course began over ten years ago and was entitled Aviation Careers. It dealt mostly with the study of the airlines and basic ground school subjects relatéd to piloting an airplane. Although it offered no flight training through the public school system, many of the students were members of the Civil Air Patrol and did themselves fly.

Since the course can be taken by any student in the school, regardless of their personal background, it was felt that more emphasis should be devoted to exposing students to a wider variety of aviation and aerospace careers, and not just those related to piloting an airplane.

Most employment in the aerospace industry encompasses many different skills and interests. The Herndon High School program attempts to look at some of these options.

During the first three weeks of the school year the students investigate the appropriate careers. While some aerospace careers require specific aviation/aerospace training, others require skills that are not specific to the field and are applicable to any field. For example, a secretary may be employed by an aerospace manufacturer, but may not have specific training in the field of aerospace. While on the other hand, an aeronautical engineer would have specific and direct training in the field. This program limits its scope of study to the aviation/aerospace field.

After the career introduction, the students explore basic aerodynamics. Early in this unit students are introduced to the glider project. Everyone is required to design a glider that will later be hand launched from the top of the bleachers at the football field behind the school. The project has a certain set of guidelines and limitations that must be followed, but these can be adjusted from year-to-year or program-to-program as necessary. Usually the gliders are constructed from balsa wood and other related modeling materials. Each student must complete a full-sized template showing enough information for the glider to be built. Realizing that most of these students have not taken a course in mechanical drawing, there must be some flexibility when approving the drawings. When the students can communicate how the designs they have put on paper can be built, the teacher will approve them. In addition, they must compute the aspect ratio and wing area before approval is given to proceed. Later, they must compute wing loading. As the project progresses, the teacher explains that if they enjoy this project, they may find engineering to be an interesting field. Also, if they enjoy working with their hands, they may find that they could succeed as an airframe and powerplant mechanic. Both of these career choices are widely employed in the aerospace field. Many airframe and powerplant mechanics are employed by NASA in the space program.

The work on the gliders usually involves several days each week while exploring various other academic areas such as performance calculations, weight and balance, density altitude, systems and instruments, and navigation.

During the gliders unit the instructor gives a basic introduction to the ATC 510 flight simulator; a small desk-top model. Being a former flight instructor, the teacher has recorded an introductory-type flight lesson that each student listens to while they fly the simulator. This flight lesson takes about twenty minutes to complete. Each individual can get through this exercise before completing the second nine weeks grading period. The simulator can be flown by an individual student while the remainder of the class works on their gliders. This method enables the student flying the simulator to not miss any class lectures. During this period, each student is required to complete a small riveting project using air and pop riveting techniques. In addition to learning hands-on skills, the students are introduced to fasteners used in the aerospace industry.

Student Constructs a Glider Wing

The program library contains numerous aerospace and aviation magazines that students are required to read as supplemental information. The students may choose what they want to read and then write a brief summary to submit to the teacher. Four of these readings are required each quarter.

After completing the first year, students may elect to take the advanced class for as many as three more years. Students electing this option usually work on the full-size bi-plane that is being constructed. Although they are offered the opportunity to work on any other approved aviation/aerospace project, most opt to work on the plane. It is an on-going project and is being fabricated from "scratch." The students are making all of the various small fittings and attachment plates. The students also have designed the fuel, electrical, and hydraulic systems. Students are also faced with the fact that this is a real project and that a certain degree of quality is necessary and these exacting standards must be maintained. If not, a part will be rejected and must be remanufactured.

During the first year and also the advanced years, various films, models, overhead transparencies, film strips are used. An occasional guest speaker may make a presentation. The first-year course is about 50% academic while the advanced course is mostly a hands-on experience. There are currently over 50 students enrolled in the first year course and about twenty in the advanced.

Funding for the airplane project has come from a variety of sources such as some financial awards from various aviation/aerospace groups and student fund raising projects. Funding for the first-year course requires no special attention and is largely covered by the normal funding that most Technology Education courses receive. Although the instructor has some background in the field of aviation, it is felt that anyone with an interest in aviation or aerospace could initiate a successful program. It is, of course, necessary to match the program with the available facility. It is also necessary to consider the type of students that will be taking the program. It is the feeling of the instructor that there is potential for all students to succeed in the exciting world of aviation/aerospace if given the appropriate opportunity.

John (Jay) Blair, Jr. is a Technology Education Instructor at the Herndon High School in Herndon, VA.

Southview High School

A School with a Mission

◆

by Fred Dull and Roscoe Schlachter

The day the futuristic furniture and the computers arrived, Roscoe Schlachter, Supervisor of Trade and Industrial Education for the Lorain City Schools, had to shove his way through students jamming the halls to catch a peek. That's the level of excitement generated by the space station simulation at Southview High School, where six girls and two boys actually lived in a five-room student-constructed "space station" for three days.

The first thing you see when you walk in the main entrance of Southview is the large mosaic inlay commemorating the Apollo 11 mission to the moon. It was this strong tie to the American space program that brought about Project FUTURE. What is Project FUTURE? It is a team effort that focuses on Further Understanding of Technology Using Realistic Experiences. The program tried to simulate, as accurately as possible, a real space mission even "launching" the "space shuttle" (a school van) with an hydraulic lift and shaking the student astronauts up a bit before placing them in the station.

Both "Mission Control" (the Macintosh Lab) and the space station (constructed of metal and wood in the school's industrial technology lab) were filled with computers that helped to provide the look and feel of a real space adventure. Mission control students used 10 Apple Machintosh IIcx computers and 10 Apple IIg computers to monitor the astronauts' experiments. Designed by students in the three months before the launch, the experiments measured reaction times of students and mice and attempted to simulate zero gravity for plants. In addition, six cameras monitored all activities in the space station for live broadcasts over the district's cable station. The public was invited to stop by the school cafeteria to watch.

Showing students that technology is an important tool they can learn to use and understand was the goal of the project, which was integrated throughout the curriculum. While science students devised experiments, language arts students wrote scripts to be used in the simulation, and home economics classes instructed the astronauts on the preparation of dehydrated food, donated by the local National Guard. Students in graphic arts designed mission patches, and developed Hypercard stacks that provided information about mission status. Communication technology students worked with English classes developing news broadcasts about the mission.

The three days of scientific experiments and live broadcasts were thrilling, says Fred Dull, Supervisor of Secondary Education, but most of the real learning took place in the three months of preparation for the project. Students throughout the school were included in the project. To design and build the simulator, for example, technology classes gave drafting students sketches of the proposed space station, drafting students used computer-aided design software on computers to prepare blueprints for welding and construction technology students who used these plans to build it.

Astronaut selection was an education in itself: 45 students competed to be among the eight astronauts aboard the final mission by taking part in eight training sessions that covered space-flight needs from computer use to personal hygiene. The astronauts were chosen on the basis of test of physical fitness, what they learned in training, recommendations from community members and teachers, and the quality of the science experiments they proposed for the mission.

The project helped students learn not only about unfamiliar technology but also about other students. "These are students who don't normally interact with each other on a daily basis: vocational education, technology education, advanced math and science students," Ray Pagan principal of Southview High School states, "I think some friendships developed there."

Students realized untapped potential in working with this project. Some students found they had the capacity to do things they didn't think they could do. Some technology education students realized they were capable of handling higher level math classes, so they signed up for the more difficult classes—an academic triumph in a

Astronauts at Their Stations

Communications Center for Mission Control

school where a majority of the students are economically disadvantaged.

"The project has very definitely stimulated non-traditional career interest among female students," Mark Emery, Project Coordinator states. "This is, in part, because six of the eight astronauts were female. We had a competition for astronauts and were afraid that no girls would compete, so we guaranteed two spots for the each sex. It ended up that the top seven participants were girls. So the two guys got the guaranteed spots." Why the unexpected result? Emery's theory: "When you specify machine trades and electronics, there's a male connotation. But when you say "space' or 'NASA,' there now are several female astronauts and it's viewed as acceptable. It's more clinical and clean than an industrial shop. The Mission Control Center is modern and futuristic."

Probably the greatest difficulty was convincing people the idea would work. "I've got to admit that when you tell people you're going to build a space simulator, lock kids in it for three days, and kids are going to volunteer for this, you're going to get some skepticism," said Mark Emery. You also increase skepticism when you tell them you are going to let the students design and build it. Building administrators were doubtful that enough teachers would volunteer for the program, estimating that eight or ten might sign up. We were hoping for fifteen or twenty and got thirty-seven. Several hundred of the high school's 980 ninth through 12th graders participated in the development of the simulator and the experiments. Students were coming in for four hours after school each night to work on the project. During the actual mission, groups of eight to ten students worked "shifts" around the clock in the Mission Control Center.

Project FUTURE doesn't entail a major curriculum overhaul to integrate this type of project into your school. You only need to change the emphasis of the projects and problems that assign. An example is instead of building a shed in a construction class, have the students design and construct a space habitat. This change doesn't leave the normal goals and objectives out, it just changes the appearance and use of the final project. In doing this type of class work over the last three years we have learned that you can teach students in a non-traditional manner by managing their activities instead of just telling them all the steps and reminding them along the way. Emery teaches by showing once, then helping, and after a short time, they find the answer.

If you were video linked to Mark Emery's classroom you would find his students working individually and in small groups on varied assignments. When students reach a frustration level independently or in groups, or simply want reassurance, their questions are answered with a question that leads them to the source or sources where they can locate the answers.

If you want to start your school on it's way to the FUTURE all it takes is commitment and a willingness to try on the part of your Faculty and Administration. If you are willing to try the rewards are significant—increased attendance, motivation, and academic achievement for students in your building. Just Do It, take a step into the FUTURE.

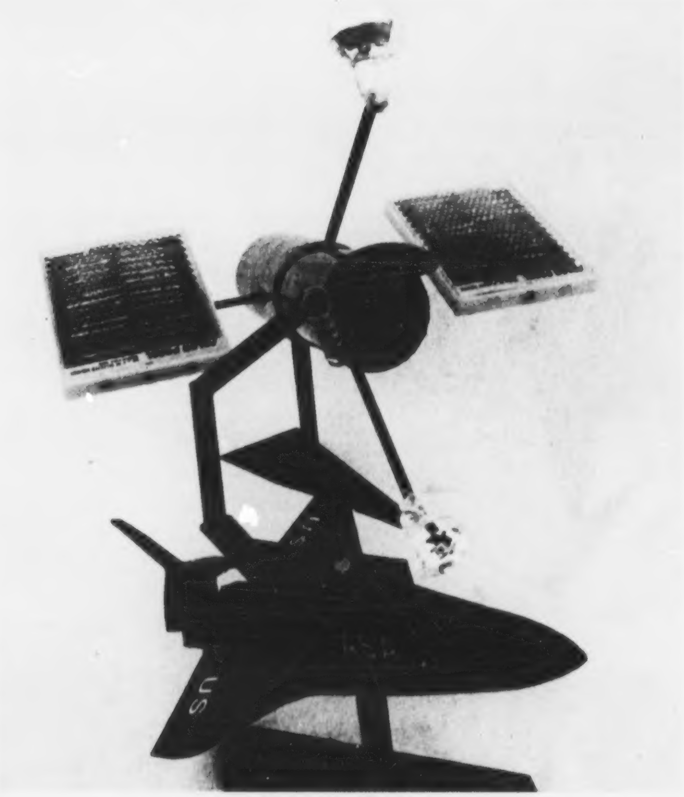
Fred Dull and Roscoe Schlachter are Supervisors of Trade and Industrial Technology and Secondary Education, respectively, at Lorain City Schools, Lorain, OH.

Their Use in Space Operations

Solar Energy and Robots in Technology Education

◆

by Dean Frame



The Hubble Space Telescope and a Space Shuttle with the Teleoperational Robot Preparing to Service the H.S.T.

Riverview Gardens High School is located in St. Louis County, Missouri, a bordering suburban school district adjacent to the City of St. Louis. The district is primarily a middle-class bedroom community with workers traveling to such employers as McDonnell-Douglas, General Motors, Ford, Chrysler, Emerson and Monsanto. With an outstanding Industrial Arts program through the 1960's and 1970's, there has been a gradual adjusting to the technology programs of the 1980's and 1990's. This discussion is a presentation of the transition made by a teacher from Industrial Arts to a Technology Education program focusing on space applications.

The interest in technology began with the energy shortages of the late 1970's when the author attended five U.S. Department of Energy and National Science Foundation workshops from Tennessee to California. The workshops involved touring several dozen installations from the Pasadena Jet Propulsion Labs, Sandia, Oak Ridge Labs, to the University of Missouri Nuclear Research Labs. All of these tours have been recorded (with slides and video tapes) for use in the classroom.

After including five-day technology units in the traditional classes, a curriculum was designed for teaching an Energy Technology class in 1981. Through the years the students have studied a wide spectrum of our energy problems, sources of energy, environmental problems, and our energy technology future. Tours have been a large part of the class with trips to McDonnell-Douglas, nuclear power plants, nuclear research labs, super-insulated homes, coal-fired power plants, etc.

Included in the lab activities are the student's construction of fully operational solar demonstration items for use in the outside laboratory. The solar items include:

- Hot Water Collector
- Hot Air Collector
- Cold Frame

- Greenhouse
- Reflective Ovens
- Parabolic Concentrating Cookers
- Food Dryers
- Heleostat Receiver Furnace
- Hot Air Engine
- Photovoltaic Sun Angle Finder
- Photovoltaic Model Cars
- Photovoltaic Powered Fans
- Photovoltaic Series-Parallel Circuits
- Photovoltaic Space Stations (Simulated)

With most of the department still teaching the traditional Industrial Arts program, in 1987 a new curriculum was designed to teach a one-semester robotics class, and a one-semester photography class.

The robotics class (limited to sixteen students) was designed for students beginning their study of the field of robotics. It began with a non-technical approach providing an overview of the parts of robots, their sources of power and their movements. Students also learn detailed information on the types of robots presently being manufactured and their present and future use in space and industry.

With three computers and a limited one-time budget of $2,000.00, a decision was made that each student would begin the semester labwork with the construction of a syringe-controlled hydraulic wooden manipulator. In this way the students would learn the basic concepts of robotics, make use of a traditional woodshop for technology, and maintain minimal cost to the school and themselves. As the students complete the manipulator, they design quick-release end effectors so they can construct and install grippers, suction cups, drills, grinders, sprayers, spot welders and other items that could be used in space and industry.

In relationship to space technology the students study the degree of similarity between our hand-operated manipulators and the teleoperated robotic devices that will construct and service our satellites or space stations. Students learn about the teleoperated arms being manipulated by the operator as a master slave unit in the cargo bay of the shuttle. As space technology further develops, more use will be made of computer-controlled robots (telerobots) to perform construction and servicing needs. The students learn that a true robot is a device that is able to both sense and manipulate in its environment at the same time. Also taught are the different ways of programming robots such as keyboard, teach pendant and hand-controlled master slave units.

Many of the second-quarter lab activities center around the three computers and software such as the Robotic Workshop, Robotic Arm, Fishertecknik Robotic Computing, Flight Simulator and other software.

The energy and robotic class students combined their efforts to construct model spacecraft, magnetic levitation devices, vacuum cleaner hovercraft and are currently building a hovercraft which will be powered by an ultra-light 8 h.p. aircraft engine.

Throughout the technology programs an effort is made to have the students understand the relationship to technology, industry and space programs and the resulting benefits to mankind.

The following classroom materials are used in the robotics program:

Textbooks

Salant, Michael, *Introduction to Robotics*, McGraw Hill

March, Peter, *Robots*, Crescent Books

Videos

NASA: Teleconference Update for Teachers (1989–90): Robotics in Space—89 minutes—Space station freedom and many other NASA space missions will make use of sophisticated space robots to do jobs that are impractical, too dangerous, or too difficult for humans to do in space, themselves.

A Learning Experience for a Future Generation of Space Shuttle Telerobotic Operators

State-of-the-art space robotics are highlighted in this program. Creative activities with robotics and computers are demonstrated.

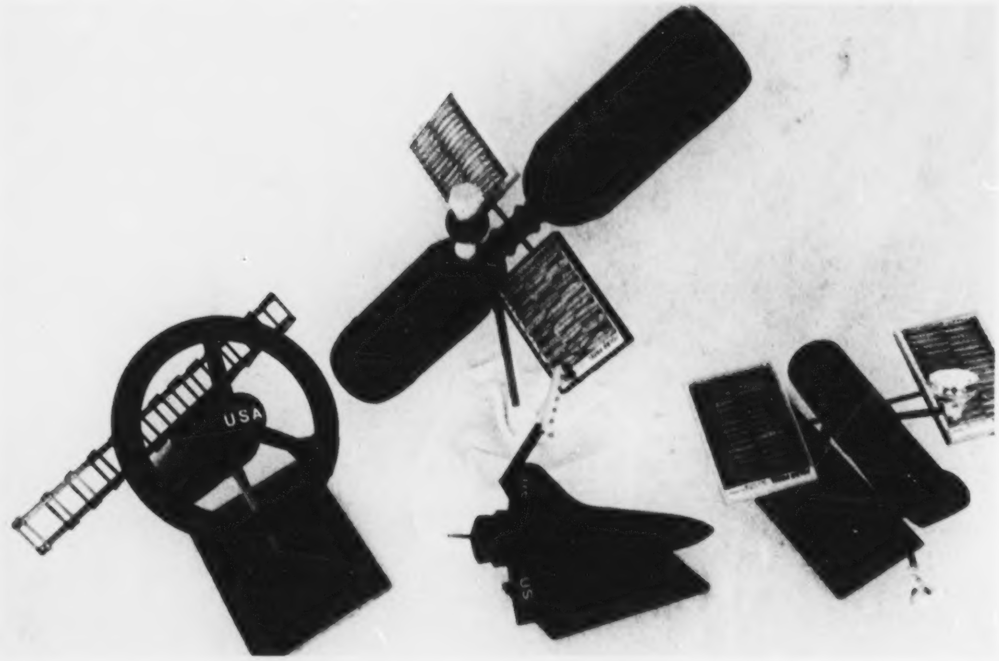
National Geographic: The Robotics Revolution—24 minutes—Robots assemble watches and automobiles, stock supermarket shelves, assist in surgery, play the organ—even build other robots! Young students learn to program a robot in their classroom. These are just some of the uses of robots featured in this film.

NASA: Space Research and You; Partners with Industry—12 minutes—Story of how America's industry can benefit from NASA technology, now, and in the future.

NASA: Space Shuttle: A Remarkable Flying Machine—30 minutes—Features first historic flight of shuttle, including lift- off, on-board activities, and landing.

Dean Frame is a Technology Education Instructor at Riverview Gardens High School in St. Louis County, MO.

A Model of a Fusion-Powered Skylab. A Horizontal Boom has been Provided for Placement of Pressurized Modules



Construction of Model Space Craft has Added to the Interest and Understanding of Technology in Space. Also Attributing to Student Interest is the Fact that one of the Pilots of our Space Shuttle is Richard N. Richards, a Graduate of Riverview Gardens High School

Copley, Ohio

Moonbase America

◆

by Carolyn Stoudt

Close-up of Main Dome

In recognition of 1992 as the International Year of Space, Moonbase America will provide students throughout the nation the opportunity to participate in a national education project. Levels of involvement are varied, but all those who commit to the project will benefit from its unique perspective on learning.

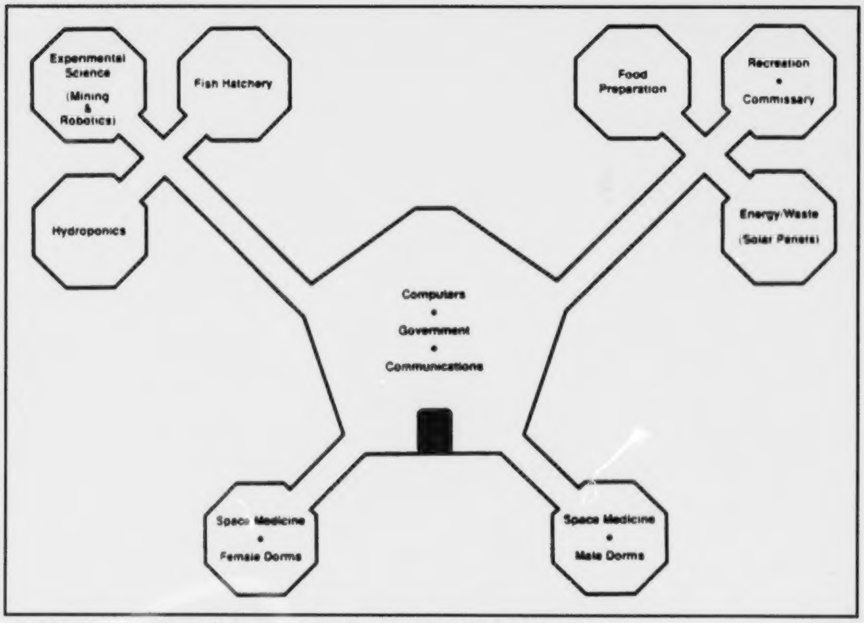
The 1990–91 Copley-Fairlawn School District project will be "Moonbase Copley." Student participants from Copley High School and Copley-Fairlawn Middle School will organize, assist in constructing, and perform all needed preparations for a self-enclosed city in which eighty-four students will man the command center outside the structure. The project will incorporate many fields of study: science, computers, electronics, mathematics, English, history and government, restaurant management, business, vocational business, physical education, speech and communication, technology, music, library science, and foreign language.

The most exciting part of this project is that the entire effort will be networked throughout each of the fifty states. One school from each state will be chosen as a major participant, dedicated to one critical area of the program: hydroponics, fish hatchery, technology, government, energy-waste management, robotics, space science experiments, and space science medicine. Seven schools will be appointed as sub-base team leaders to which six other satellite schools will report experimental results and solutions to planned and unplanned problems. These fifty schools will be designated by the word "Moonbase" followed by their school district . . . Moonbase Copley, Moonbase Sheldon, etc. The scope of participation is unlimited because all other interested schools will follow a general coinciding curriculum and be offered the opportunity to participate in the one hour television broadcasts to be aired each of the seven days of the occupancy of the Moonbase. The national curriculum will be developed through the support of nationally recognized high school and college instructors.

The project officially began on June 1, 1990 with the national announcement of the project. During the 1990–91 school year, the course . . . space science will be offered to Copley student applicants. During after school hours, all Copley and sub-base satellite teams will receive additional training in their specific fields through meetings led by faculty members, guest speakers, and professionals in related fields. Included in these sessions will be physical training courses, curriculum materials, special seminars, etc. During this period, the curriculum guide will be distributed to interested teachers who wish their students to follow the project goals with their students. In September, 1991 the actual construction of Moonbase Copley will began. The basic structure includes one large 50 foot diameter dome connected by corridors to eight 25 foot diameter offshoot pods. Two of the pods will be reserved for sleeping quarters, while the others will be devoted to experimental labs, the fish hatchery, an hydroponics plant, food preparation, recreation, energy and waste management, and space medicine. The center dome will house the computer, communications, and government divisions.

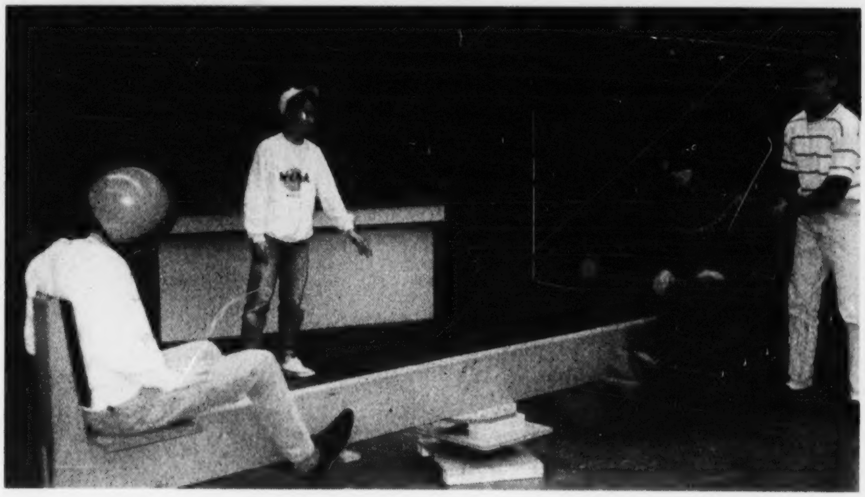
In April, 1991 the students will live in "Moonbase Copley" or operate the command center for seven days. The Copley site will receive experimental results and solutions from the seven major sub-base schools through a direct computer link. These seven schools will in turn receive communications from their six satellite schools. During the residency, PBS will broadcast a one hour documentary on the project, highlighting critical areas of the project. Also included will be an overview of all the other schools involved. In addition to this, ten video cameras will record the entire 168 hours of the occupancy. These tapes will later be edited into a documentary on the Moonbase project.

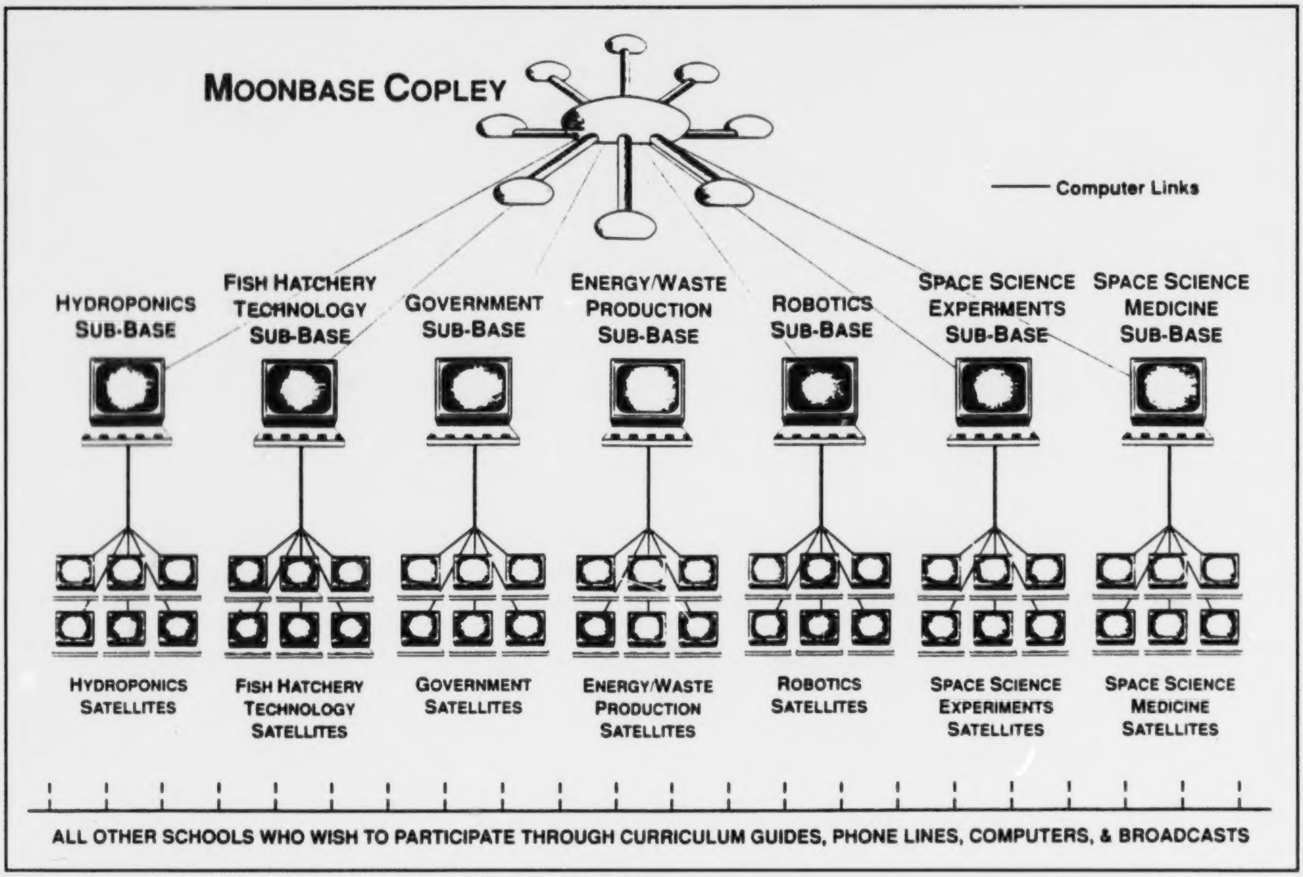
When the project is finished, all student team members, both Copley and nationally, including teachers and parents will be requested to submit an


Experimental Science (Mining & Robotics)
Fish Hatchery
Food Preparation
Recreation • Commissary
Hydroponics
Energy/Waste (Solar Panels)
Computers • Government • Communications
Space Medicine • Female Dorms
Space Medicine • Male Dorms

The Moonbase Structure will Consist of One Pentagonal and Eight Octagonal Domes

Experiments in Fluid Flow




MOONBASE COPLEY
Computer Links
HYDROPONICS SUB-BASE
FISH HATCHERY TECHNOLOGY SUB-BASE
GOVERNMENT SUB-BASE
ENERGY/WASTE PRODUCTION SUB-BASE
ROBOTICS SUB-BASE
SPACE SCIENCE EXPERIMENTS SUB-BASE
SPACE SCIENCE MEDICINE SUB-BASE
HYDROPONICS SATELLITES
FISH HATCHERY TECHNOLOGY SATELLITES
GOVERNMENT SATELLITES
ENERGY/WASTE PRODUCTION SATELLITES
ROBOTICS SATELLITES
SPACE SCIENCE EXPERIMENTS SATELLITES
SPACE SCIENCE MEDICINE SATELLITES
ALL OTHER SCHOOLS WHO WISH TO PARTICIPATE THROUGH CURRICULUM GUIDES, PHONE LINES, COMPUTERS, & BROADCASTS

As the Diagram Illustrates, the Project was Designed for all Levels of Participation

evaluation of the project. Industrial sponsors and other participants will also be encouraged to provide their assessments. These reports will be compiled into a comprehensive procedural outline and evaluation of the "Moonbase Copley" project. This will be available to all education, civic, and corporate organizations who request a copy.

It is extremely important to point out that the success of such a large-national endeavor depends upon support and commitment by teachers, students, administrators, community, industry, etc. Critical to the ultimate success is the participation by industrial sponsors. The following are a few examples of support by corporate sponsors that are key to the "Moonbase Copley" effort. First, the dome structure design and engineering is being guided by Oregon Dome, Inc. This Eugene, Oregon based company has provided an easy to assemble and disassemble sub-floor and geodesic building system, which will provide a strong and energy efficient environment for the project. Stouffers Food Service, Inc. will supply a nutritionist to act as a consultant as students prepare a menu for participants involved in the project. Summa Health Care System, Akron, Ohio will assist the students by providing medical equipment, including respirators, EKG diagnostic monitors, and other related and necessary equipment for this project. The Astronomy Club of Akron, Ohio is also participating in the project. This organization will be providing technical support in the area of space sciences research. This club has an extensive educational outreach program in Ohio. Their assistance will be invaluable to the success of this effort. Finally, the Radisson Inn-Montrose will host students, teachers, and other participants in the Copley areas during April, 1991. Again, it is so important to involve as much of the community as possible. Give every organization an opportunity to get involved.

At the heart of any education project lies its goals—the objectives the students are to accomplish within the course. The scope of Moonbase America allows a wide range of possibilities, and teachers can mold these to fit their own teaching styles, their students' abilities, and their school system's structure.

The following are the preliminary educational objectives for the MOONBASE AMERICA project. It is expected that, as the national course guide is developed, there might be revisions and/or additions.

Technical Goals

- Moonbase America will provide students with the opportunity to understand and use the scientific method.
- Moonbase America will provide the students with the opportunity to define and apply selected natural laws.
- Students will operate and maintain equipment not readily available in a high school.
- Moonbase America will provide students with the opportunity to understand how the physical and the life sciences are interrelated.
- Students will have the opportunity to examine the physical state of the earth and its relationship to the universe.
- Students will have the opportunity to investigate the effects of, and predict possible outcomes of, man's intervention in his environment.

Citizenship Goals

- Students will be involved and responsible for group problem-solving in real-life situations.
- Moonbase America will provide a structure so that students learn to meet specific goals and responsibilities.
- Students within Moonbase America will research and develop their own form of government.
- Moonbase America will provide students with the opportunity to foster an appreciation and enthusiasm for science.

Construction of Moonbase

- Moonbase America will provide students with the opportunity to understand the impact of science on career choices.

This course is designed for the student interested in science and its interaction with space. The course involves researching, using computers to collect and analyze data, studying ecological systems, solving problems before and during the week-long simulation within the Moonbase, experimenting in the physical sciences and communicating all findings.

Moonbase America is an educational endeavor that is ahead of its time. America has always been interested in exploration, moving constantly towards distant frontiers. This same spirit is incorporated into "Moonbase Copley." This project provides for team work. It will provide the opportunity for significant problem solving. It provides for simulations where the mind and imagination are the only limitations in the quest to explore the future. As Toffler said, "if education has the wrong image of the future, education will betray us." Moonbase America-Copley provides an educational model for the future. It represents a change in the approach to teaching and learning. It truly is ahead of its time. But has the time already arrived?

Carolyn Stoudt is the Project Director and Teacher for the Moonbase Project at Copley High School in Copley, OH.

Sauk Rapids High School

Aerospace Education

◆

by Curt Olson

Testing Propeller Designs—Data Analyzed By Computer to determine Results

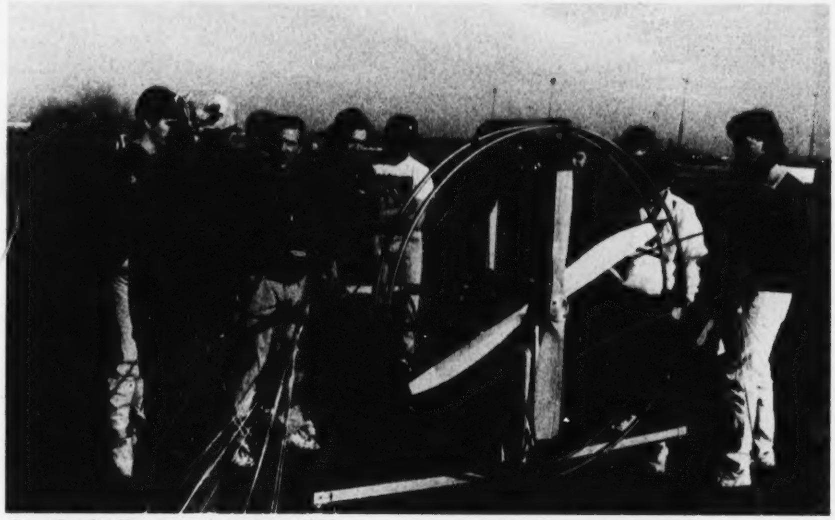
In the Spring of 1988, a partnership was formed between the Sauk Rapids High School technology department and NASA's Lewis Research Center. The goal of the partnership was to develop a general education Aerospace Technology curriculum for the secondary level, with an emphasis on "hands-on" activities that stress problem-solving and applied math and science skills. This program was presented to aviation educators and representatives of the aviation industry in Minnesota for review and revision. The final draft of the curriculum will be made available to all NASA Education Resource Centers throughout the country for use by teachers to incorporate Aerospace Technology in their science and/or technology curriculum.

The curriculum is an Aerospace Technology model for the State of Minnesota Department of Education—Technology Education, the Minnesota Department of Transportation—Division of Aeronautics and partnerships have been established with NASA Lewis Research Center, and Northwest Airlines. It has received numerous honors and awards including, the "Award for Excellence in Aviation Education" from the General Aviation Manufacturers Association and the Minnesota Christa McAuliffe Fellowship Award from the U.S. Department of Education for 1990-1991. The purpose of the award is to provide outreach programs on Aerospace Education and further develop our aerospace and applied technology curriculum.

The curriculum is designed to be 36 weeks in length with emphasis on aviation during the first eighteen weeks. Units on space and the applied technologies needed for atmospheric and space transportation are covered during the second semester. (Many of the units and activities could be implemented into an existing general technology program.)

The first nine weeks of class are very structured to facilitate an overview of

Assembly of Radio-Controlled Glider


Guest Speaker Demonstrating a Parasail Plane

the technical and social aspects of aviation. The second nine weeks stress aircraft design and construction. Some of the units and activities included in the first semester are:

1. The role of NASA in Aerospace Technology
2. NASA technology spinoffs
3. History of aviation
4. Principles of flight
5. Aircraft systems and performance
6. Basic navigation
7. Meteorology for flight
8. Aircraft design and construction
9. Career opportunities and post secondary schools

Technology learning activities include:

1. Paper airplane design and construction
2. Small balsa airplane design and construction
3. Discovery flight, Cessna 152
4. Release of a 30″ helium balloon to monitor atmospheric conditions
5. Computer modem, weather analysis
6. Propeller design, construction, test, and assessment
7. Construction of radio-controlled glider aircraft
8. SpaceLink—computer interface with NASA

The major difference in this program occurs in the second semester. Students are divided into teams to promote interpersonal skills and cooperative learning. Each team is assigned a problem that is presently being worked on at a NASA research center. The student team must research the problem, design a project that reflects their research, and present their findings to the class. Some of the units include:

1. The Solar System and Beyond
2. Past, Present, and Future of Spaceflight
3. Principles of Rocketry and Propulsion
4. Technologies Needed to Explore the Solar System

- Robotics
- Fluid Power
- Radio Communications
- Radar Systems
- Thermo-Sensing
- Satellite Communications
- Space-Age Materials (advanced composites)
- Opto-Electronics
- Living and working in space
- Career opportunities and post-secondary schools

Technology learning activities include:

1. Wind tunnel design, construction, and testing of various airfoils
2. Lunar base design, and construction
3. SpaceLink-computer interface with NASA
4. Satellite dish set-up (satellite orbit mechanics)
5. Rocket design, construction, flight, and analysis
6. Robotic controls systems for Aerospace
7. Fluid power systems for Aerospace
8. Radar system analysis
9. Micro-gravity simulation in the swimming pool
10. Lunar rover design, construction, and test
11. Amateur radio

BEST COPY AVAILABLE

Students Working on Propellers and Gliders in Lab

Satellite Receiving Station Set-up—Used to Study Orbital Mechanics and Remote Sensing

At Sauk Rapids High School this program has only been offered to 11th and 12th grade students, where it has been very well received. On an elective basis, approximately one third of the student body enroll in this class prior graduation. The class meets daily, 48 minutes for thirty-six weeks. We are also enrolling students from other schools through Minnesota's open enrollment program. (In Minnesota students can enroll in the school of their choice free or charge.)

When surveying the students' feelings about the class, some of the following comments were made:

> "I loved the challenge of the class"
> "It's our future"
> "I liked working in a team to solve problems"
> "Science and math concepts are finally making sense to me"
> "We succeeded, it works"
> "I plan to pursue a career as an air traffic controller"

The Future

Our plan is to continue to offer this program and improve the curriculum each year. Because technology is changing so rapidly, it is critical that the instructors provide a continuing research and update effort. In addition, a major effort will be made to establish and maintain a program that features content integration. Technology Education truly provides the environment and focus necessary for effective cross-curricular instruction. Aerospace Technology just happens to be one very exciting area for high school students to explore. Although the initial focus will be the integration of mathematics and science. It is also very important that all other curricular offerings be included in the cross-curricular effort. The future looks bright. Finally, a realistic and workable program exists for establishing a holistic approach to learning at the secondary level.

Curt Olson is a Technology Teacher at Sauk Rapids High School, Sauk Rapids, MN.

It's not for Ground Pounders anymore!

Aerospace an Educational Catalyst

◆

by Jim Kyd

I've always had a strong Industrial Arts program, however, I wanted to attract more students, at all levels, including girls. Searching for possibilities, I attended the ITEA Conference in Kansas City, and came home inspired to infuse more technology into my program.

I started enriching my curriculum with advanced technological experiences and began looking for ways to change. I became active in the MITEA and started interacting with teachers who are the movers and shakers in my field. The fellowship was supportive, exciting and fun.

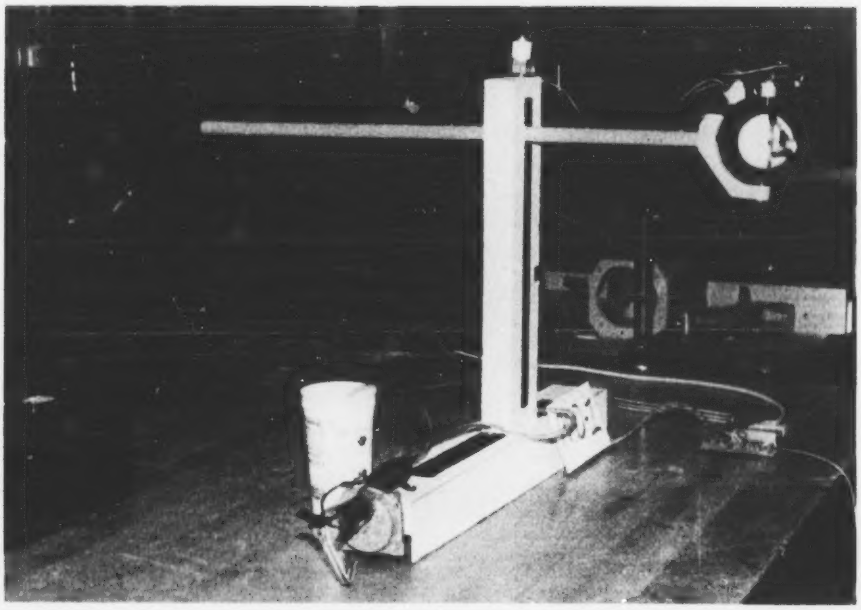
In 1985, at the ITEA Leadership Conference, Dr. Jim Bensen's presentation pulled the traditional Industrial Arts rug out from under me. He spoke of the world knowledge base, the totality of what we know, doubling every three to five years. He stated that 40% of the job options available to my ninth graders as graduating seniors didn't even have a name yet!

I thought I was supposed to be teaching entry level skills for industry. What do you teach students that will help them throughout their lifetime? Dr. Bensen spoke of critical thinking, problem solving skills, English, math, science and producing literate consumers of technology. The more I thought about it the more excited I became. This could be lots of fun! My classes could be more open, dynamic and stimulating!

Fortunately, Missouri had been working extremely hard developing a set of state guides to move Industrial Arts into the 21st century, and technology into the classroom. These guidelines became part of my technological bedrock on which to build my program.

As a teacher, I have found technology to be a wonderful stimulant. I've always believed: "Tell me and I'll forget, show me and I'll remember, involve me and I'll understand." When I think of involving technology, what comes to mind are "spinoffs." Our space program has funded a tremendous amount of "public domain" technology. The more we research, the more

First Prototype of the OMV



BEST COPY AVAILABLE

we realize how spinoffs impact the quality of our daily lives. Students become so focused and excited trying to discover and apply a spinoff first, they forget that what they are doing is "school work."

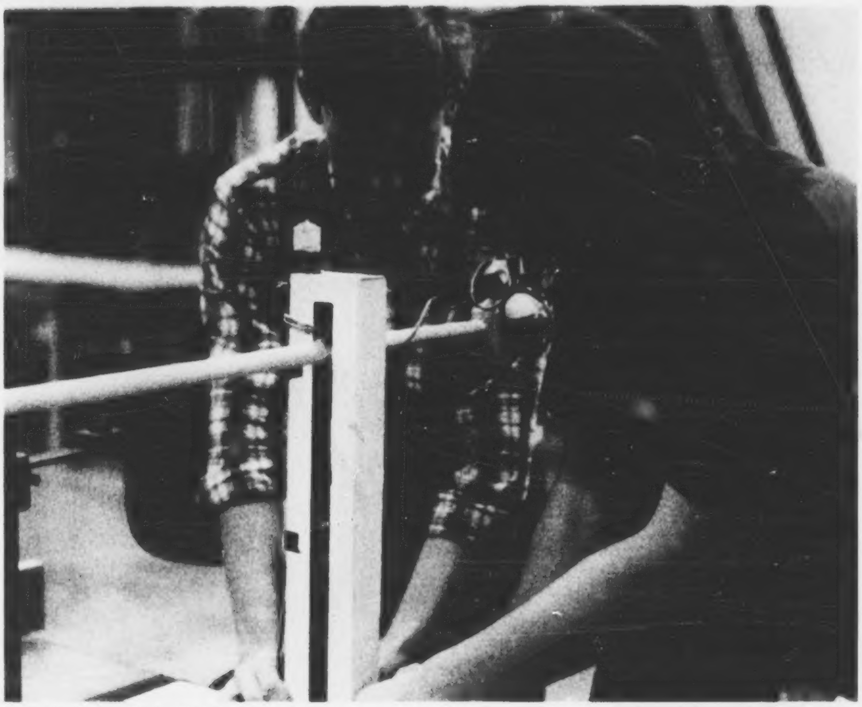
Students love Aerospace Technology because it's fresh, fast-paced, challenging and cool! I love Aerospace Technology because students willingly integrate other academic disciplines into their projects.

The Principles of Technology class (PT) is team taught with the Physics teacher for a science credit. We try to set up hands on experiences that teach scientific principles. The first half of the course is learning how to measure, calibrate and interface our environment with a computer. The second half of the course is using what you have learned to dream, scheme and build a worthwhile "project" of their choosing. All projects must be thoroughly documented and "patented." You first receive your patent (from the teacher) assuring project uniqueness. The patent must be a well conceived idea and be presented in a formal written document.

We follow an 8-step problem solving procedure:

1. Clearly State the Problem
   (What's the problem?)
2. Design Specs/Judgement Criteria
   (How do we decide what's the best solution?)
3. Research all known information about problem
   (We need to know all we can about the problem?)
4. Propose Possible Solutions
   (What are the possibilities?)
5. Experiment with (3) best solutions
   (These have the best chance of working)
6. Based on Modeling and Criteria Pick the Best Solution
   (Pick the best solution)
7. Apply Solution to the Problem
   (Let's try it out)
8. Evaluation of the Solution
   (Did it solve the problem?)

Every student starts the project with a 3 ring binder and their "patent." Each step of the problem solving process must be carefully written by the student, reviewed by the teacher and initialed before the next step can be taken.


OMV Prototype Under Construction

One exciting activity is the "ET" project. The ET (External Tank) of the space shuttle is 153.8 feet tall, 27.6 feet in diameter, weighs 66,000 pounds empty and reaches 99% of orbital velocity before it's jettisoned. As it tumbles back toward Earth, it breaks up leaving it's "footprint" of debris in the Indian Ocean. The students felt that since it would only take a tiny payload penalty to put the "ET" into low orbit (250–300 nautical mile above the earth) we should develop viable alternatives to making multi-million dollar footprints of debris.

Once the students had clearly stated their problem, and written their criteria, the excitement of researching "ETs" began. They first used our computer and modem to log into NASA SpaceLink and down-load everything we could find on "ETs." Next, they contacted the Space Science Institute and were surprised to find that extensive ET research has been going on since the 1970's. One of the more interesting projects, described by NASA, was a CAD project called "Tanker Toys." The more we investigated, the more we were intrigued by the possibilities. A perk of this process (if you have an understanding administration) is the experience students receive when calling and interacting with NASA and other major corporations. It is so important to pursue resources outside the school! Actually, Aerospace Technology is so contemporary that most information is not available in the school.

Martin Marietta Manned Space Systems makes the ETs and was extremely helpful in our fact-finding attempts. DDK Technologies and Steve Wadell of Modern School Supplies were extremely supportive with leads and technical support. We are in the process of contacting the Kansas Cosmosphere, the Air and Space Museum in Washington, D.C., the Challenger Society, Final Frontier Magazine, the St. Louis Space Frontier Society and the National Space Society. We are confident they will not only give us useful information, but additional leads as well.

Once all the data is in, the entire class will help the core groups brainstorm possible options. Each core group will produce a "brief" and chair the brainstorming session. They will then continue, step by step, through the problem solving process until they have completed step 6, "Picking the Best Solution."

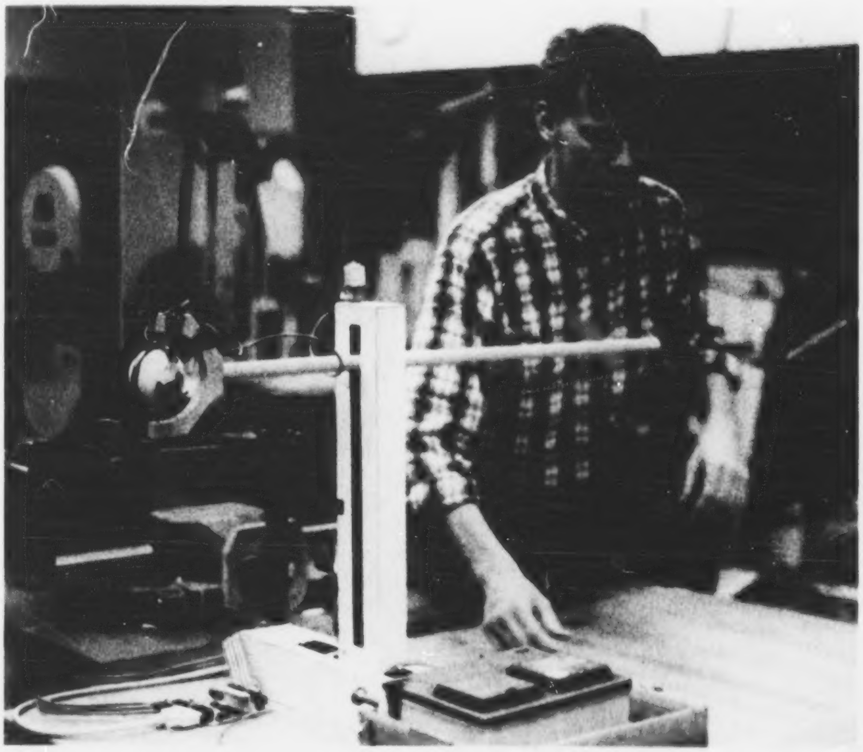
Another Aerospace adventure we're attempting is the OMV (Orbital Maneuvering Vehicle) project. OMVs will be used on the space station, "Freedom," as "Space Tugs" moving cargo and equipment. One of the problems is the 1 to 3 second time delay between issuing an OMV command and the OMV reaction. This is due to the long distances the signals have to travel between the command centers and the OMV. Another problem with OMVs is operating them in 3 dimensional space while observing them on a 2 dimensional screen. This can dramatically increase frustration levels and cut down one's accuracy. Add this to a 3 second command reaction feedback delay and things can get real exciting.

We decided to build an OMV model and practice docking maneuvers. The plan is to use an RC (radio controlled) unit working an on-board CPU with a built-in time delay. The OMV will be observed using a video camera hooked to a monitor in the next lab.

Our first problem was to research, design and build an OMV. While we were doing our research, we also planned our OMV model design. NASA SpaceLink helped again. We also worked with TRW, The National Space Society, SSI, The Challenger Society and Marshall Space Flight Center's OMV office.

The first model idea was a platform tethered to the shop ceiling and pushed using a ducted fan. Our team decided the vertical movement would be too limited. We then explored using an air table made from a sheet of peg board. We decided that we could calculate our OMV's mass and platform size easily. Then, we developed an air-bleed, redirect system that used valves and plastic

Checking for Electrical Continuity of OMV

Preparing to Try Another Test Run of the OMV


tubing to bleed air from a point of the platform and redirect it, to "push" the OMV. This idea quickly fell into a quagmire of weight restrictions, limited vertical movement, high degree of sophistication and cost. Next, we thought of a helium balloon with an internal heater. The heater could expand the gas inside the balloon and the ducted fan on the attached platform could help lift or move the OMV in any direction. The latest brainstorm was to use a large aquarium or stock-tank and develop a submersible OMV. We could easily address the OMV weight-water density situation by adding mass if necessary. Using a large container with clear glass walls we thought camera vision would be adequate for documenting the entire process. We even found a SCUBA diving camera case to use if needed.

Another group responsible for the OMV docking procedure has made the whole process into a game. The female part of the docking device will have a internal load cell to monitor the OMV's "docking impact" and 2 strain gauges to monitor accuracy. The operator who docks with the most accuracy and the softest touch wins a soda and a certificate making them a member of an elite group of tug drivers! Believe me, the competition will be fierce!

I have found that keeping my room full of reference books and periodicals has a major impact on the projects' success rates. At first, students thought magazines like *Design News* and *NASA Technology Briefs* were too technical for them. However, they soon started thumbing through them, found items of interest and were hooked. *NASA Technology Briefs* is very technical, but it also introduces students to major corporations and their products, exposes them to possible vocational options and gives a great overall perspective of NASA's operations and contributions to society.

My enrollment is now 45% of the student body. One-third of that is female. Every year the student's projects are more involved and sophisticated. Even so, I still use my table saw, bandsaw, hand drill, etc; and teach the basics, including safety.

In Technology Education, the teacher becomes a facilitator of the learning process. There is no way I could have all the answers to the problems that were encountered during this effort. I learned as much, if not more than my students. We were all placed in a constant state of "critical thinking" to solve one problem after another. The realization of the value of a well conceived—exciting Technology Education program was dramatic. Technology Education significantly prepares todays students for tomorrows challenges.

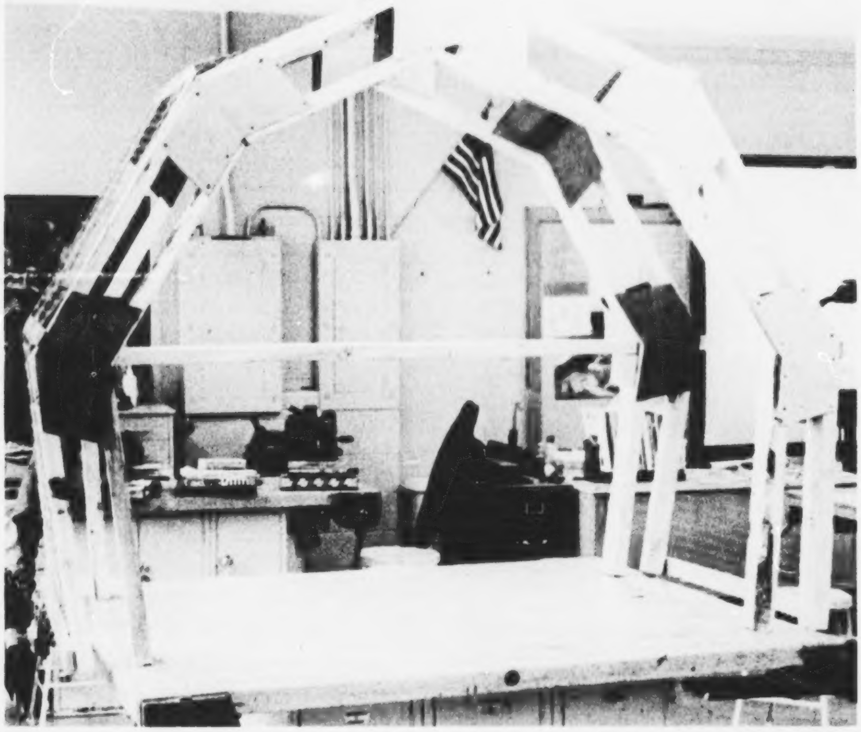
Jim Kyd is a Technology Education Teacher at South Callaway High School, Mokane, MO.

Mission Control to Lunar Base

◆

by Craig Adams and Pat Daugherty

Space Habitat



Improving the educational experiences that enhance the teaching-learning process in the classroom is a constantly challenging task. Activities that demonstrate the integration of various technologies studied in Technology Education classes are sometimes difficult to realize. Topics such as lasers, robotics, computer assisted design and manufacturing, graphic communications, hydraulics, pneumatics, and electronics are all contemporary topics in our Technology Education studies. However, it is difficult to find strategies which clearly demonstrate how these very different technologies are combined to perform incredible tasks for humans. There is a constant search for truly exciting and relevant instructional activities that will permit this understanding of technological cooperation and interdependence.

The Central Project

To address this need for new and exciting activities, Rock Bridge High School has decided to use a concept that is not new, but has strong implications for Technology Education . . . the central project. The concept is rather simple. The idea is to develop a group project which focuses on a central or key theme. This strategy allows teachers and students to really become creative and resourceful. This concept also provides for relatively easy content integration and cross-curricular instructional activities to occur. Because of these qualities, this approach was adopted by our Technology Education department.

International Student Space Simulation

The Technology Education department's personnel joined an organization know as ISSS—International Student Space Simulation. As charter members of ISSS we were given a wealth of information and resources that enabled our project to get started. Included with this information was: information which described how to build a space habitat, catalogs which offered various materials useful in constructing the habitat and mission control center. As you can tell, Aerospace Technology became our focus for the central project idea. This focus created so much enthusiasm and excitement for Technology Education and eventually other subjects. It was just what we were looking for.

One of the unexpected bonuses for the department was the selection of Pat Daugherty for a trip to the Marshall Space Flight Center in Huntsville, Alabama. He obtained various sources of information such as . . . videos, posters, books, photos, and contacts for additional resources. Pat was also able to experience tours of NASA's space simulators. This trip was invaluable to the overall success and quality of our own space simulation effort.

Serious Problem Solving Occurs as Construction Takes Place

Cross Curricular Approach

The space simulation activity offered many opportunities to "connect" other subject areas. The home economics department assisted with food preparation and diet specification as well as storage recommendations during the simulation. Experiments with dehydration and packaging were conducted. The science department and psychology classes helped construct appropriate experiments for the mission. The art classes were asked to help design a lunar landscape, a project logo, and a patch design for astronaut uniforms. Several classes turned the activity into an extended class assignment. As time moved on, more and more classes wanted to get involved with the project. The entire effort actually demonstrated the relationship of all subjects with each other. Students finally realized that the real world does not separate math from science, art from history, language from home economics, etc. All subjects are interconnected.

Expanding to Other Schools

After witnessing the ability for this project to bring together content areas within the same school, it seemed reasonable to go beyond the school and involve other departments in neighboring schools. Jefferson Jr. High School was the first to get involved. They assisted with some of the mission experiments at first, but recently they have expanded their involvement to other aspects of the project.

One of their efforts was the design and construction of a stress-reaction test for astronauts to use during their stay in space. At regularly scheduled times the astronauts would take the test to see how the mission was affecting their reaction times. Data was collected and conclusions were drawn about stress during extended space missions. Their involvement continued to generate a storm of enthusiasm for Aerospace Technology activities.

The central project continues to grow. Students from two other junior high schools and one other high school are making plans to participate in upcoming mission activities. Some of the projects include: the construction of a shuttle for transporting visitors to the space station. The design and construction of a hovercraft for docking simulations, and a robotic arm for simulated repair stations. Plans are also being made to conduct a student exchange with Canadian students in the near future.

The central project on Aerospace Technology has proven to be an overwhelming success to all who participated. The faculty received an exciting and relevant way to provide instruction for Technology Education. The students were able to participate in a truly unique and exciting experience while in high school. Teachers and students were able to experience learning that wasn't broken up into 40–50 minute intervals. Abstract concepts in the academic courses started to make sense to everybody involved. The cooperation and intense participation was both refreshing and inspirational. Aerospace Technology really provided the catalyst for a real "fun" learning experience for all. The central project on "lunar base" is here to stay.

Craig Adams and Pat Daugherty are Technology Education Teachers at Rock Bridge High School, Columbia, MD.

A Practical Approach to Interdisciplinary Education

The Central Project Model

◆

by Larry J. McHaney and L. Jerry Bernhardt, Jr.

A simple discovery caused some radical changes and opened incredible new doors for McCullough High School. Last year we began a space simulation program which has had a dramatic impact on the entire community. The school's first academic pep rally; visits from and discussions with congressmen, senators, state officials, astronauts, influential community leaders, newspaper and television reporters; increased student excitement about school and parent involvement represent only a few of the effects felt so far. What started off as a small step for the Technology Education department at McCullough High School has mushroomed and grown into a giant leap for International Cooperation and Interdisciplinary Education. What we discovered was how to unleash student potential through what we call the "Central Project" and "Component Project."

What is a Central Project?

The idea of a central project is not new, in fact, it is quite old. Frank White quotes Edgar Mitchells' Institute of Noetic Sciences to point out several historical central projects including the Egyptian pyramids, Gothic cathedrals and more recently the NASA's Apollo project. He goes on to say that central projects are a "means of focusing the energies of a population during an evolutionary transition to a higher level of culture" (White, 1987). In schools a central project is a topic around which students, teachers administration and the community as a team focus their energies. With only slight modifications of existing curriculum, teachers can plan at least a portion of their curriculum to correspond with the central project theme and guide students toward the development of at least one component of the central project. We found that with a little creative thinking, every school discipline can adapt and apply at least a small part of its curriculum to become involved in some aspect or "component" of the Central Project. (See Figure 1)

Many educational leaders believe that the strict departmentalization of the high school must be abolished to help students understand the interconnections between subjects and between school and the rest of the world. In innovative schools, the central project can be the stepping stone for experimenting with this theory. On the other hand, the existing curriculum does not necessarily have to change. What changes is that teachers and students are asked to develop their assignments and projects around a specific central theme. Research papers, math projects, science experiments, social studies activities, art, drama, and musical presentations, and vocational projects are developed around the central project. Halls, bulletin boards, class rooms, and the cafeteria are all decorated and display information related to the project.

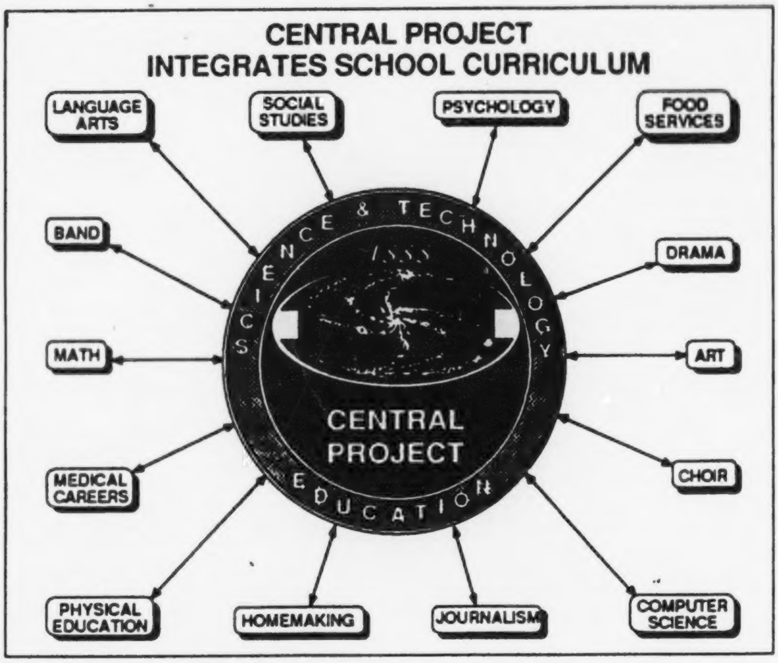
What is a Component Project?

All forms of business and industry are actually orchestrations of component projects which are brought together to form a central project which they hope will be a salable product. Much like industrial projects, central projects are usually too large and intricate for any one person or class to complete and must be broken down into smaller, individual or group projects that we call component projects. Many component projects can be divided again into subcomponents. Students learn the difficulties of coordinating, communicating and consolidating their efforts in a complex organization.

McCullough's Central Project Student Space Simulations (SSS) 1987–88

SSS began last year when second year Architecture students, tired of drawing typical residential and commercial buildings, wanted to try something different. Given the problem description, students worked enthusiastically to research, design and build a habitat which would sustain four people in an outer space simulation for 72 hours and then, carry out the three day mission and wrapping it up with a final evaluation of the project. Thus was born Project Space Station.

A few days later, the second year Technical Drafting students asked how they could get involved. The Space Station needed an Orbital Maneuvering Vehicle (OMV) with mechanical or



Central Project Integrates School Curriculum

robotic arms to launch satellites and do repairs so the Technical Drafting class assumed the responsibility of designing and building it. They soon learned that they could not complete the task alone. They began to work with the Metal Technology students who helped to develop and produce components for the OMV and its arms. Wood Technology students developed and produced containers to hold experiments, food and clothing. They also produced plaques to give to the project's major contributors. Almost every student enrolled in a Technology course got involved in the project. Figure 2 shows some of the component projects that made up Project Space Station and how they relate to our new Technology Education curriculum.

Students who had never taken a technology course came to us asking how they could get involved. Others asked their teachers in various subjects if their class could participate in some way. As the project continued to grow we began to realize how much we needed the talents of other students and teachers. We had help from students and teachers representing almost every group in the school. In all about 400 students worked on the many components of the Space Station. We started the McCullough Students Astronauts club (McCSA) to help consolidate the great variety of students.

Some teachers integrated the project into their curriculum by developing, submitting and monitoring experiments which the crew performed during the mission. The food services classes researched space food and then precooked and packaged all the meals for the astronauts. The Art department decorated the commons area with creative space art. The math classes helped with water volume, air replacement and weight calculations and also prepared an experiment determining astronaut response time that was performed during the actual mission. Physics classes helped build robotic arms, language arts students prepared the astronauts for all of the writing that would be required, and the social studies classes took an active part in soliciting support and participation from local, state, and national elected officials.

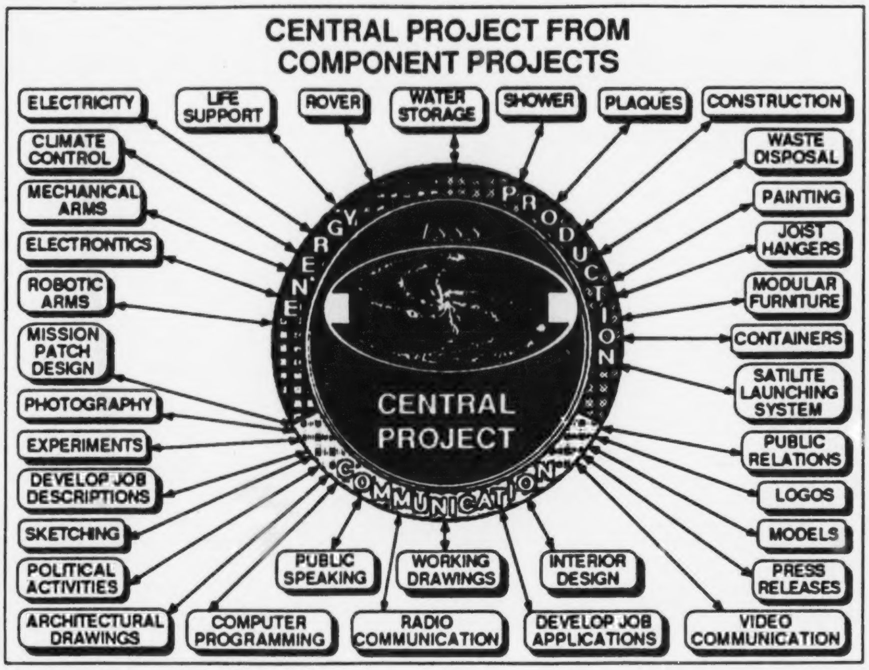
Individuals and companies in the community pitched in to support the project. Some donated money, materials or discounts on needed items. Others gave their time and expertise which lead to professional mentorships and even job opportunities for some students. One example of this mentorship involved a doctor who worked for NASA during the Apollo missions. He read about our project in the Houston Chronicle and called us. He invited a couple of our students and a couple of medical careers club students, who were developing a medical experiment for the mission, to come down to his laboratory at the University of Texas Health Science Center so he could show them the proper way to conduct the experiment. A mother of one of our astronauts volunteered to drive and sponsor the group's trip.

The space station was set up and the mission carried out on the stage in the commons area of the school for everyone to see. At the blast-off celebration (pep rally) the whole school and many families and people from the community packed the gymnasium as the McCSA students entered like the football team and sat in the seats of honor. Congressman, Joe Barton and Astronaut, Dr. Joe Allen encouraged and praised the students, the school and the community for their vision to attempt such a project and their perseverance to complete it.

The first night of the mission we held a Space Station extravaganza to give more people in the community a chance to see the mission in progress. The school jazz band and choir performed to open the event. Later in the evening Senator Phil Gramm called from Washington; John Trebes, director of the space station mock-up facilities at the Johnson Space Center; and Dr. Larry Bell, President and founder of the Sasakawa International Center for Space Architecture at the University of Houston spoke to the audience of about 1200 people. The crew performed experiments as the crowd watched by video camera and then launched a satellite (a helium balloon) with a peace message written for the occasion by elementary school children.

Criteria for a Successful Central Project

An idea for a central project, in order to be successful, should fulfill certain criteria. It must:


CENTRAL PROJECT FROM COMPONENT PROJECTS
ELECTRICITY
LIFE SUPPORT
ROVER
WATER STORAGE
SHOWER
PLAQUES
CONSTRUCTION
CLIMATE CONTROL
WASTE DISPOSAL
MECHANICAL ARMS
PAINTING
ELECTRONTICS
JOIST HANGERS
ROBOTIC ARMS
MODULAR FURNITURE
MISSION PATCH DESIGN
CONTAINERS
SATILITE LAUNCHING SYSTEM
PHOTOGRAPHY
PUBLIC RELATIONS
EXPERIMENTS
DEVELOP JOB DESCRIPTIONS
LOGOS
SKETCHING
MODELS
POLITICAL ACTIVITIES
PUBLIC SPEAKING
WORKING DRAWINGS
INTERIOR DESIGN
PRESS RELEASES
ARCHITECTURAL DRAWINGS
COMPUTER PROGRAMMING
RADIO COMMUNICATION
DEVELOP JOB APPLICATIONS
VIDEO COMMUNICATION
ENERGY
PRODUCTION
COMMUNICATION
CENTRAL PROJECT

Component Projects—Project Space Station

- Stimulate interest
- Incorporate the community and available resources
- Activity based
- Be Interdisciplinary
- Be made of component projects
- Encourage creativity
- Provide recognition in the school and the community

The following paragraphs expound on the above criteria.

Stimulate Interest

A recent survey of workers in America asked them to rank, in order of importance, the ten aspects of their jobs that keep them motivated. Surprisingly, "interesting work" topped the list (Kovach, 1987). We live in what is probably the most exciting era ever known. Is it any wonder that many students, tired of being taught the same old thing in the same old way, complain that school is boring and worthless? Many continue to ask, "Why are we learning this? How will it ever be of any use to me?" Thus Thomas McDaniel made his first commandment of student motivation "Thou shalt build an interesting curriculum" (McDaniel, 1985, p.19). Speaking on educational reform, Earnest Boyer said, "the heart of the effort would be a creative look at curriculum in relation to the future and not the past" (Brandt, 1988, p. 9). To insure the central project's success, it must capture the imagination and interest of students, faculty, administration and the community. At McCullough High School, we chose a space-related project because it is the work place of tomorrow and we felt that in our community it would be the best topic to stimulate the interest required. Not unlike young people of the early 1800's who dreamed about the western frontier, a great number of today's students are fascinated with and drawn to their frontier: Space. With the achievements of this century in mind, today's students know that they will be the engineers, architects, designers, scientists and technicians of the twenty-first century—a century that will no doubt see the exploration and colonization of many parents of our solar system. Astronauts are still thought of as heros in America and the space program continues to be looked upon with awe by the general public; therefore, we feel that programs which deal with space will generate a great deal of excitement among students, faculty, administration and civic leaders in almost any community.

Incorporate the Community and Its Available Resources

The future of our country and our way of life depends on the quality of education our students receive (Adler, 1982), therefore, business, community and educational leaders need to realize their interdependence and work together to make education the responsibility of the entire community not just a handful of paid professionals. Too often schools become "isolated entities" and "self-contained communities" (McDonald, 1986, p. 752). The importance of community involvement in schools in well documented. "The growing thriving partnership in America" (Instructor and Teacher, 1986, p. 6). These partnerships help students feel like a part of the community (Boyer, 1985) while providing the school greater access to technical, financial and political support (Wilson & Rossman, 1986). A good central project can help build lasting partnerships for the school and establish mentorships between professionals in the community and students.

As mentioned earlier, space projects appeal to all types of people. Being located just north of Houston, the Woodlands and McCullough High School are close enough to make use of the Johnson Space Center as a resource for information and field trips. Our project was well timed to elicit great community support because, at this time there is also much hope that the development of NASA's Space Station will help revive the Houston area's economy. During the course of our project, many professionals, including doctors, engineers, architects, university professors, video experts and more, gave their time, energies, equipment, expertise, and sometimes money to help our students succeed. Businesses in the community helped by providing supplies and materials free of charge or at tremendous discounts. The budget for our project totaled $3,500. While in operation, the simulation consisted of approximately $20,000 worth of equipment. Much of the computer and video hardware had been loaned from other

MCSA
PATHFINDER

Project Space Station

schools in our district and businesses in the community. This year, knowing of our project, a bank in the community donated a FAX machine when they upgraded to a newer model. A security company and grocery chain donated security video cameras, VCR's and monitors when they no longer had use for them. Research shows that the people who are more involved with schools "perceive them more favorable" (Wilson & Rossman, 1986). Those involved in Project Space Station think highly of McCullough High School. Other schools may be located in areas in which other topics for central projects may be more applicable or generate more interest and participation than space projects. Consider the needs, interests and resources of the community, then choose a project which is best suited for your students and your community.

Activity Based

Another key factor is that the project not only be studied and designed on paper, but it must be used and tested for the whole school and community to see. "All genuine learning is active, not passive," (Adler, 1982) therefore, the motto for Project Space Station was

> "I hear and I forget; I see and I remember; I do and I understand."

Having worked as a professional designers, we knew the thrill and exhilaration of having one of my ideas and designs recognized and fulfilled. There is a creative drive in the nature of every human being which finds great regard and fulfillment when we see our ideas come to life. Space simulations motivate students to actively research and develop creative solutions to many realistic design problems and then actually build, test and use their designs.

Interdisciplinary

Few "real-life" problems can be solved by utilizing one specific field such as math or English. The problems in today's world are difficult and complex and tomorrow's will be even more challenging to solve. Students, in order to obtain a "well rounded general education," are required to take a wide variety of separate subjects in school. We assume (quite naively) that they transfer knowledge between these subjects and understand their relationships to each other and the world. We also assume that students can integrate and apply what they have learned from the various subjects when they leave school. Imagine a student who has not mastered basic math skills, working on a vector problem in physics or learning to use a scale in drafting. Or, a scientist who discovers a cure for cancer but does not have the communication skills to disseminate the wonderful news.

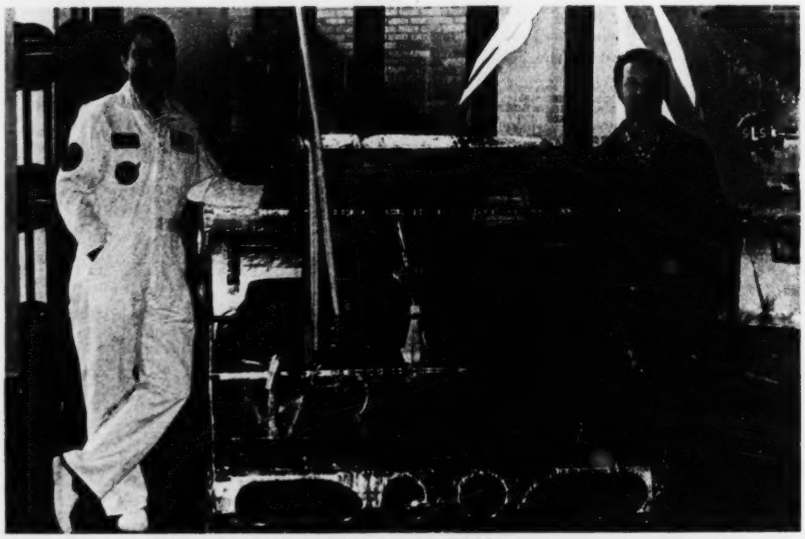
In his book *High School*, Earnest Boyer said, "While we recognize the integrity of the disciplines, we also believe their current state of splendid isolation gives students a narrow and even skewed vision of both knowledge and the realities of the world" (Boyer, 1983, p. 114). It is our job "to help students integrate knowledge and apply it to the world they will inherit" (Brandt, 1988, p. 5).

We, as educators, need to see "our subjects" not as isolated entities and ends in themselves, but as tools to be used together to solve problems much like a hammer and nail are tools to solve the problem of fastening two boards together. "Teachers must play a key role in making these connections between the disciplines. They must view curriculum in a more coherent way. We cannot expect students to see relationships that teachers do not see" (Boyer, 1983, p. 114). The central project model helps teachers and students develop an understanding not only of the interrelationship (what Boyer calls "connectedness") among curriculum components such as math, social studies, language, science, health, business, home economics, art and technology to name a few, but also between school disciplines and the "real world."

The central project model provides students with the missing step in the education process by giving them rare opportunity to synthesize and apply a vast array of knowledge from different disciplines throughout their educational careers into significant and meaningful, practical applications. Students involved in SSS quickly learn that it takes more than scientists, architects and engineers to get humans into space, especially as the duration of missions grow toward permanent space habitation. It will take artists, writers and politicians to sell the projects. Future space ventures will require business professionals and accountants to establish cost projections and controls; psychiatrists, psychologists and medical doctors to keep the crew happy, motivated and healthy; experts will be needed in nutrition, exercise, development free time activities and games and myriad of other professionals working together to make outer space a livable, affordable home.

Like the technologies of tomorrow, the space simulation project is much too complex and sophisticated for one person to design. The project is broken down into smaller tasks, called component projects, which are developed by design teams. The central project helps students develop group interaction skills which will be an extremely important part of their lives. The design teams are made up of students throughout the school. The space simulation and its component projects give students in every discipline the opportunity to apply the concepts they have learned and to interact with students in other classes to achieve a common goal. The simulation project is truly interdisciplinary and helps students to recognize the relationships that exist between the different subjects in the school.

As a part of our simulated mission, physics students submitted a super conductor experiment while McCullough's Government and English classes worked with Canadian classes to develop a space treaty which astronauts were asked to finalize and ratify. The students took this experiment very seriously. They now realize that there remains many extremely difficult and important issues about space that they will someday be forced to resolve. Art and psychology students submitted environmental experiments, there were also medical, biological and psychological experiments. Food service classes researched food production, preservation, storage and preparation to develop space food for the mission. They also had to write concise and easy to follow preparation directions for the astronauts to follow. The band and choir wrote and performed special music at the prelaunch pep rally and our Space Extravaganza and working with math and computer students submitted a musical experiment to test the affect different types of music had on the astronauts' ability to perform. English, business and typing classes already required to write formal letters, now write letters to important officials and media personalities about the project and invite them to attend. The central project gives real meaning to assignments. Students become excited when allowed to apply their individual talents and focus their energies on one common, realistic and meaningful goal.


The authors pose with the O.M.V.—Orbital Maneuvering Vehicle

Made Up of Component Projects

The next criterion is that the central project consist of a number of component projects. While students must plan and work together to integrate components into the larger system, choosing a specific portion of the project which interest them most allows students to personalize their educational experience while retaining a sense of belonging to a team and feeling ownership in the whole mission. Students gain mastery on a specific topic and must display their knowledge in an observable behavior: the completion and integration of their component project with the central project. Many proponents of education reform want to require students to demonstrate their achievement in order to be eligible for a high school diploma. The successful completion of a component project could be used as part or all of a required "Senior Project" (Boyer, 1983, pp. 115–116) or "Student Exhibition"(Sizer, 1986, p. 41). The number of component projects will depend on the number of students involved and the central project itself. Even a small central project can have a great number of component projects. It is important that each student in the class get involved in some capacity. At McCullough, we found that even lower-achieving students, once involved, became very excited to find their talents a useful and necessary asset to the mission. If, by chance, there are not enough component projects to go around, different design teams can be formed to work on the same problem much like industries compete.

Encourage Creativity

Each component project should be posed to the students in the form of an open-ended problem. We believe that all students have great potential for ingenuity and creativity when given the opportunity to exercise and develop their abilities. Using the Central Project Model, teachers should give the students a small list of design criteria and try very hard not to limit creativity. A well written component project problem description will not suggest any methods, materials or lead students toward any specific solution to the design problem. Students must actively seek the skills and knowledge needed to successfully meet the criteria. Students become more responsible for their own education (Boyer, 1983) as advocated by many leaders in education reform. As Adler suggests, teachers are no longer the "knowers who attempt to put the knowledge they have in their minds into the minds of their pupils" (Adler, 1982, p. 50). Teachers may leave the didactic form of teaching and move into Adler's second and third column which employ the pedagogues of coaching and Socratic dialogue. Student questions should be answered with probing questions or one of our favorite responses "I don't know. What have you found?" At first students will dislike these teaching styles because most are accusation to getting immediate answers. These methods of teaching are powerful tools which help students to develop critical thinking and problem-solving skills. Students learn to follow the steps of the design process and to use the scientific method in order to develop projects.

Invitation to International Student Space Simulations (ISSS)

Planning has already begun for simulated missions through 1992 (The International Year of Space). Next year's mission will involve students from across North America and around the world as we develop an international coordinated, simultaneous space simulation mission for the 1989–90 school year. We invite all interested schools to research, design, develop, plan, build, operate and evaluate a simulated space habitat and mission control. We are trying to link interested schools, students and teachers with others who would like to take part in the International Simulation. In an effort to make the 1989–90 mission as realistic as possible, mission goals were developed which closely paralleled NASA's development of the international space station. Monday, January 29, 1990 began the 72 hour mission, in memory of the Challenger crew members. ISSS worked to establish a telecommunications and a video communications link with all participating schools. Simultaneous missions allowed students to become familiar with online video and computer communication technologies, so they could share ideas and experiences, while learning to overcome the barriers of time and distance to communicate within a large organization and coordinate a complex project.

The purpose of the ISSS simulations is strictly educational. We wanted to emphasize creative thinking and problem solving, which does not necessarily require the use of expensive and sophisticated equipment. ISSS helped students learn to use the resources they have to their fullest potential.

Summary

The central project is an excellent model for implementing current educational theories. We truly believe that the central project has the potential to revolutionize all of education. McCullough's Space Simulations have been a great success because space was the right central project for that particular time and community. The space habitats and their components allowed students to pool and apply their knowledge from various subjects and experiences while working on a meaningful and realistic project. The pep rally and extravaganza gave students the recognition they deserved for all of their hard work and gave the community more access to school activities. Our central project not only got students throughout the school involved along with their parents and many members of the community, but it actually got them interested and excited about what was going on at school. Any well chosen central project can help schools practically implement prominent educational theories while making relatively small changes to the existing curriculum. We are confident that the implementation of the central project model can be an exciting and rewarding experience for students and teachers throughout the school and the entire community.

References

Adler, M. J. (1982). *The paideia proposal: An educational manifesto.* New York: MacMillian Publishing.

Boyer, E. L. (April, 1985). Social and moral imperatives for the future of our schools. *The Education Digest.*

Boyer, E. L. (1983). *High school: A report on secondary education in America.* New York: Harper & Row.

Brandt, R. (September, 1988). On the high school curriculum: A conversation with Ernest Boyer, *Educational Leadership.*

Kovach, K. A. (Sept-October, 1987). What motivated employees? Workers and supervisors give different answers. *Business Horizons.*

McDaniel, T. R. (September, 1985). The ten commandments of motivation. *The Clearing House.*

McDonald, A. (June, 1986). Solving educational problems through partnerships. *Phi Delta Kappan.*

Sizer, T. R. (September, 1986). Rebuilding: First steps by the coalition of essential schools. *Phi Delta Kappan,* p. 41.

What advocated say about partnerships. (Winter, 1986). *Instructor and Teacher.*

White, F. (1987). *The overview effect: Space exploration in human evolution.* Boston: Houghton-Mifflin.

Wilson, B. L., & Rossman, G. B. (June, 1986). Collaborative links with the community: Lessons form exemplary secondary schools. *Phi Delta Kappan.*

Larry J. McHaney and L. Jerry Bernhart are Technology Teachers at McCullough High School, Conroe, TX.

Shuttle Victoria

◆

by Bob Calhoun

Payload Specialist Demonstrates Weightlessness System

In the northwest mountains of North Carolina, students at the Ashe County Career Center completely simulated a NASA Space Shuttle Mission.

The classes are made up of 11th and 12th graders who travel to a centrally located vocational school. Through the work of the Technology Education classes, the windowless classroom became the Space Shuttle Victoria. So named for the only surviving ship in Magellons' fleet in 1522.

Flight Objectives

The following items are attained during each shuttle mission:

- To plan a Space Shuttle Mission.
- To research past shuttle missions.
- To arrange our classroom similar to the Shuttle.
- To monitor NASA via satellite.
- To use flight simulators on the computer for launch and landing.
- To actually be in our classroom simultaneous to the NASA Mission.
- To plan and store all meals on board.
- To have a camera in the classroom for others to monitor our flight.
- To have a camera in Mission Control for the flight crew to view that area.
- To prepare experiments to do in the cabin and in the cargo bay.
- To place computers at the other high schools for teachers to send homework through the modem to our on board computers.
- To monitor NASA through SpaceLink telecommunications network.
- To share our flight through telecommunications with other schools around the world.
- To simulate weightlessness with cables and rope system.
- To use headset walkie-talkies for communications.

Classroom Setup

The classroom is a natural for this type mission in that it is almost identical to the actual space shuttle. Being divided by a wall, the cabin is only 100 square feet larger than the real one and the other room, the cargo bay, is the exact size as NASAs'. Scaffolding was placed in the cabin to make it two stories with the flight deck above and sleeping quarters, eating and exercise area below. Overhead, exposed beams are used to support steel cables with a pulley system to move our astronauts around the cargo bay area in which students are not allowed to touch the floor during the entire mission.

Mission Plan

Five students and the instructor will be chosen with five others as backups for the mission. The flight crew will consist of a Commander, Pilot, Two Mission Specialists, and Payload Specialist. Having committees of 21 students, we will prepare all systems for the launch previous to the expected actual NASA launch. On the day of the NASA launch, the crew will enter and prepare simultaneous to the shuttle crew while monitoring the NASA satellite via Satcom F3. Using the shuttle simulator, Orbiter Computer Program, the commander and pilot will go through the liftoff procedures. If for some reason the real Space Shuttle flight is scrubbed, the crew will wait till the next appointed time for liftoff. If there is a hold in the countdown, then the crew will remain in their seats till orbit is achieved. Once in orbit, the class will monitor and carry out experiments the flight crew have in place. The crew will adhere to the same schedule for meals and sleep as the astronauts. Having completed the multiple day mission and using the flight simulator, the crew will re-enter the orbiter and complete the mission.

Shuttle Committees

The following committees are necessary to plan and carry out a successful mission . . .

- Nutrition Systems
- Satellite Deployment
- Communications Systems
- Computer Systems
- Mission Plan
- Physical Setup
- Experiments
- Public Relations
- Finance Committee

Shuttle Victoria Report

The first mission was scheduled for April 28, 1989. For NASA this was STS-30 aboard Shuttle Atlantis. (Known as the Magellon mission because of the planetary probe bound for Venus.) It was 5 months from the original idea until the actual process began. Technology students in Media Communications, Construction Planning and Design, and Research and Development classes began the awesome process of totally simulating a shuttle mission. So many things go into the flight such as, suits, public relations, securing enough food for five days, and the storage and cooking equipment needed. We found tremendous support from our community. With a population of only 20,000 people in our entire county, we were provided with all our needs—from van seats for the crew, satellite dish, refrigerator and a microwave. Over one mile of coax, phone, and fiber optic cable was rolled out for communications.

Prior to launch, like the NASA counterparts, a news conference was held. Students, parents, representatives from business and industry and school board members attended. With the mission control as the back drop, we explained

Last Minute Work on the Cabin Seats

The Crew of Shuttle Victoria

BEST COPY AVAILABLE

Computer Simulator in Mission Control for Systems Analysis and Trouble Shooting the On Board Simulator

the mission and answered questions. Also attending were reporters from several newspapers and television stations. Following the press conference, we opened the shuttle for a tour and demonstrated some of the shuttle systems. In the cargo bay was a model of the Magellon Satellite (10 feet in diameter and 15 feet long). Along with NASA's release of the satellite, students released a smaller model attached to helium balloons from our school. The one in the cargo bay was disassembled during flight. Members of the Health Occupations classes provided us with equipment and charted our health prior to launch three times each day. They recorded blood pressure, weight, heart rate, and temperature.

On April 28th, the crew discovered the true realities of space flight. After four hours in our seats the first attempt to launch was scrubbed at T-31 seconds. There was a faulty pump in main engine number one. On May 4, 1989, we lifted off at 2:47 P.M. Once in space, the crew encountered a faulty electrical system which kept throwing the breaker when the microwave was used. That was replaced. On our second night the refrigerator began defrosting with three days of food inside. After three hours of checks and trials, the problem was located—A box of french fries in the door shelf was pushing the defrost button every time the door was closed! As you can probable tell, it was a problem solving bonanza. A daily report was placed on TechLink from each student which described each days problems and solutions. Monitoring NASA via satellite was just like being there with every conversation heard in our room. However, the real excitement came on the last day of the flight when the class received an autographed picture from the Atlantis crew and a phone call from mission control in Houston, Texas. One of the engineers talked to the crew for over 30 minutes. Needless to say, we were all weightless at this time! (One interesting side note—during this launch the state TSA competition was being held and two of our astronauts competed via a speaker phone hookup.)

The next flight took place at the State Fair in Raleigh, N.C. Here, we had to build our shuttle and transfer all our cables and computers in October, 1989. One new addition to this flight was the use of video telephones. One of our experiments came from a kindergarten class and we were able to send them live pictures to their classroom—200 miles away.

The next flight was in March, 1990. On this flight students were back in the classroom shuttle launching the Hubble Telescope. The tomato seeds from STS-32 LDEF recovery were used to run final experiments.

Bob Calhoun is a Technology Teacher at Ashe County Career Center, West Jefferson, NC.

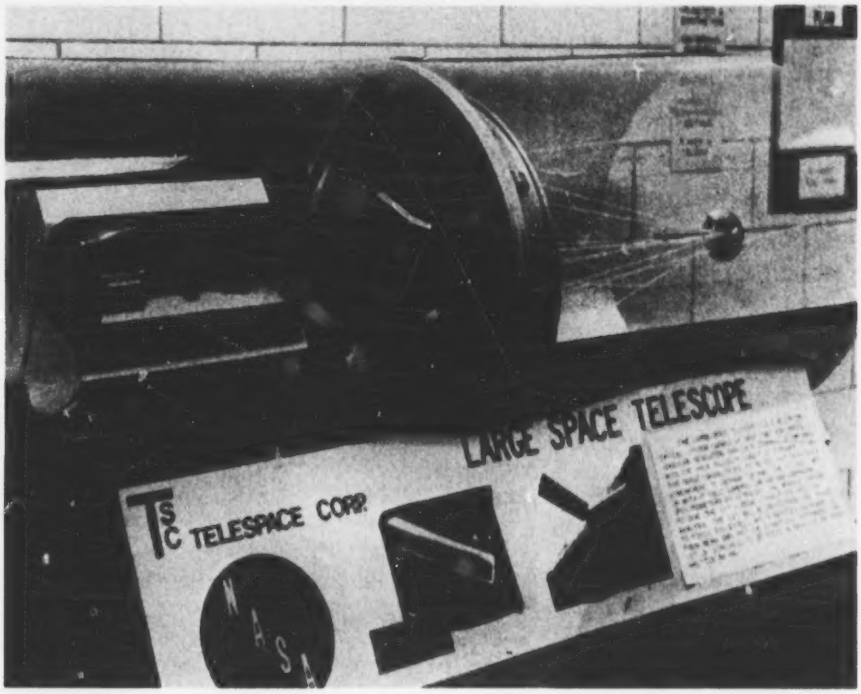
Students Played A Vital Role

Development of the Hubble Telescope Project

◆

by Donald Maley, D.T.E.

The Completed Model that Remains on Display in the Department



This is a historical narrative of how the students in the author's Practicum in Industrial Arts class (1975) at the University of Maryland played an important role in the development of the recently launched Hubble Telescope. The story unfolds as follows.

It all started with a telephone call from Mr. Richard N. (Dick) Crone, Educational Programs Officer at the Goddard Space Flight Center at Greenbelt, Maryland to Donald Maley (then) Professor and Chairperson at the Department of Industrial Education at the University of Maryland, College Park.

The telephone conversation and the ensuing series of events were as follows:

Mr. Crone: "Good morning Don, this is Dick Crone from the Goddard Space Flight Center."

Dr. Maley: "Yes, Dick, what can I do for you?"

Mr. Crone: "Has your class started their group project yet?"

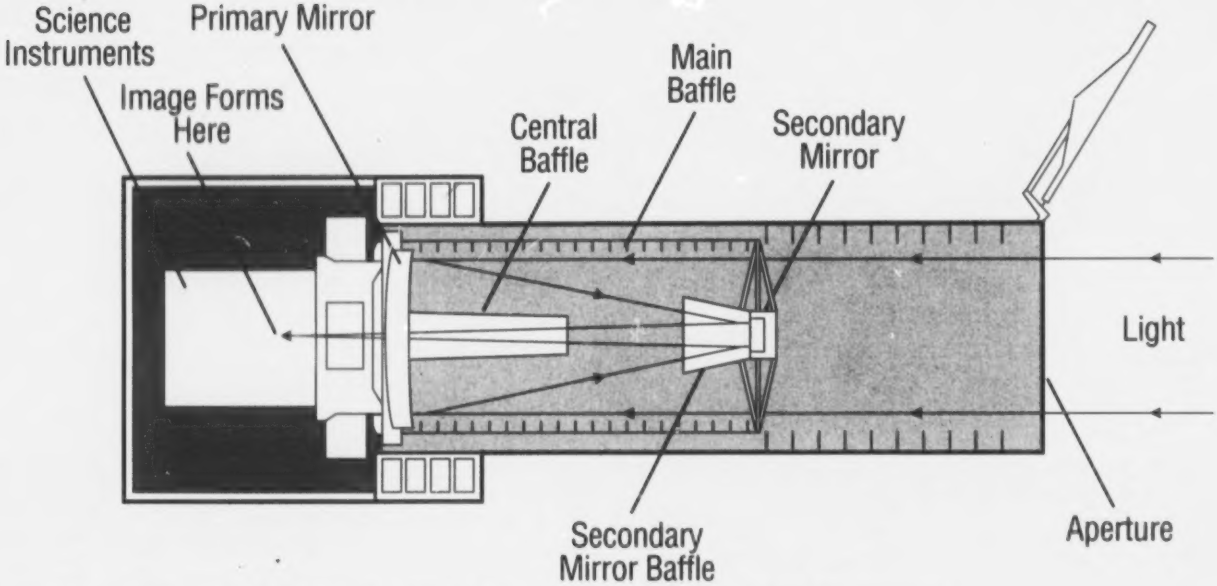
Dr. Maley: "No, not for another two weeks yet. By the way, how do you know we do group projects in my class?"

Mr. Crone: "Don, we know more about what you do than you think we do. Can we come over to discuss a project for you?"

Dr. Maley: "Why yes, please come over, we will be pleased to see you."

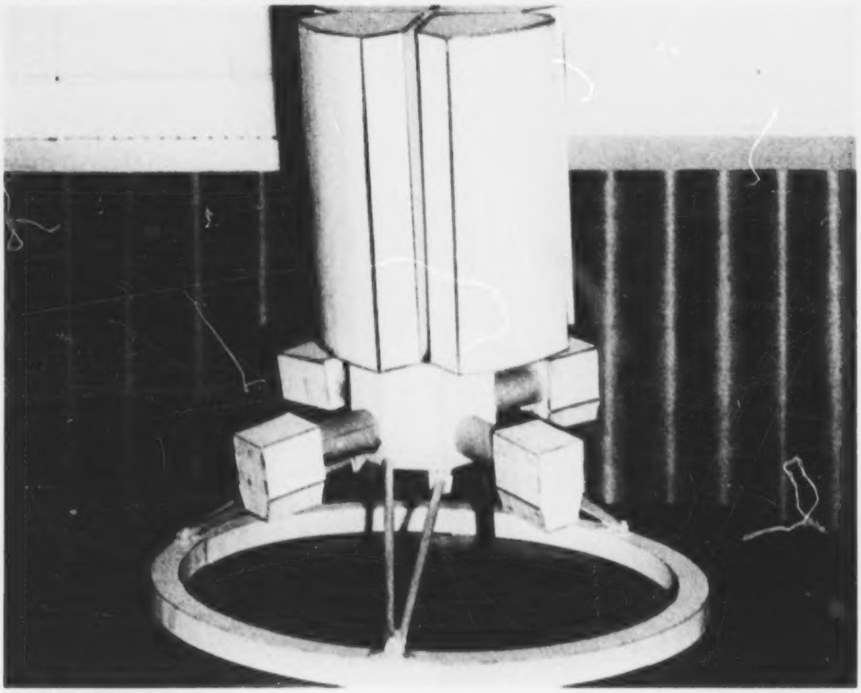
This conversation was followed by a visit to the Industrial Education Department by Mr. Crone, Dr. George M. Levin, Project Director on the Large Space Telescope for NASA, and a technician. The purpose of this visit was to explore the possibility of the Practicum in Industrial Arts class taking on the building of a prototype of the instrument section of the projected Large Space Telescope (later identified as the Hubble Telescope). The requested prototype was to include a mockup of the working components units that were located in the aft part of the total telescope and attached to a circular frame just behind the primary mirror. See Figure 1 (on the next page) for the particular components and location.

BEST COPY AVAILABLE



Path of Light through the Telescope to the Detectors (from NASA's Exploring the Universe with the Hubble Space Telescope*)*

The Completed Instrumentation Mockup that was Constructed for NASA



The requested section of the space telescope was to be constructed so that the various segments could be disassembled and transported in a suitcase to various governmental, science, and contracting groups to illustrate and describe what was needed as well as the general geometry of the area in the telescope in which the various scientific instruments would be housed. The disassembly capability was accomplished by having the various components held together with dowel rods fitting into holes in matching parts or units.

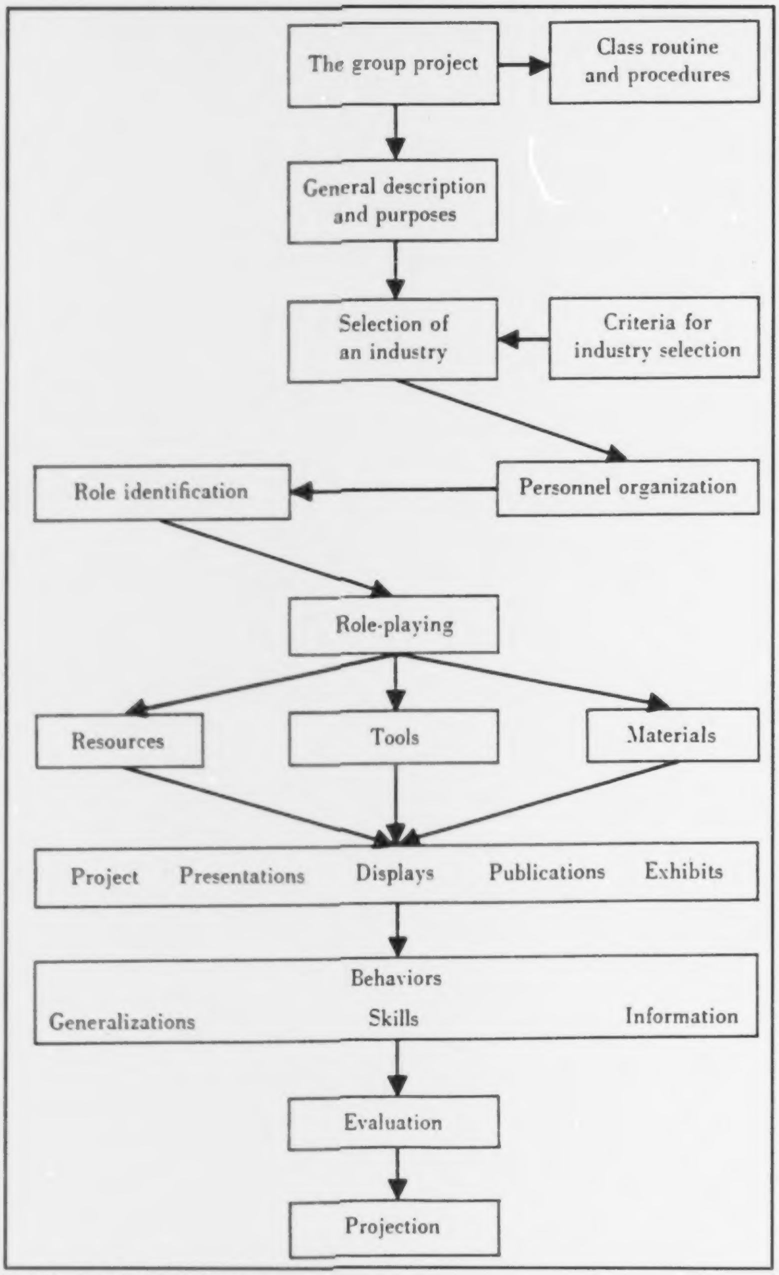
The project was then discussed with the total practicum class. The students agreed with considerable enthusiasm to take on such a group project and also to have a part in one of humankind's most ambitious projects in space. A total of five weeks of class time was allocated for the group project experience. The number of students in the class was 14, all of whom were in Industrial Arts Education. It was also agreed that the model segment requested by the Goddard Space Flight group would be made according to their requirements (size, disassembly, etc), and that a second model would be made for the Industrial Education Department at the University of Maryland. This would include the total cylindrical structure, with internal components and mirror arrangement. It did not include the solar array panels that are deployed in space to provide solar energy for the internal functioning units.

Photo 1 is a photograph of this project, which is still on display in the Department at the University of Maryland. The completed project that was made for NASA is shown in Photo 2.

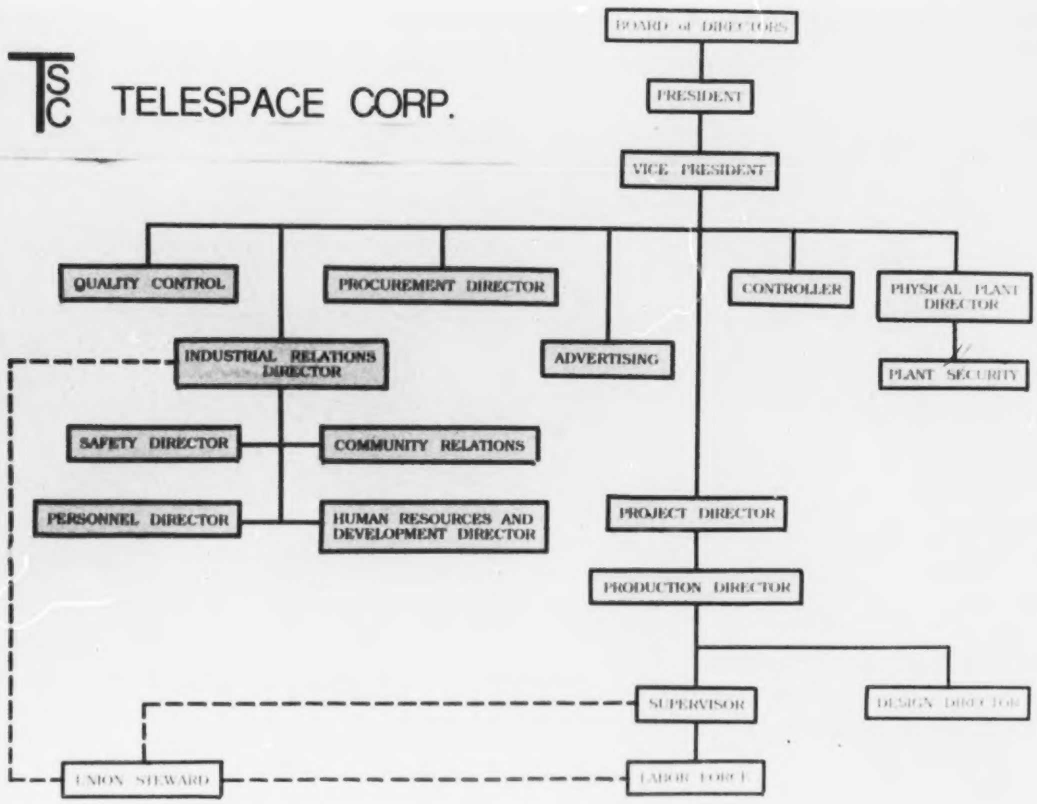
The carrying out of this exciting and challenging project was planned and executed in accordance with the established educational designs for group projects as presented in the "Maryland Plan" for teaching Industrial Arts and Technology. A schematic of the educational sequence design is presented in Figure 2 on the right.

The organization of the class to construct the desired units and at the same time have a rich educational experience involved a number of important activities associated with the development of a class organizational structure that would be most effective.

- A formal project organizational structure was set in place with a broad range of personnel positions such as—board of directors, president, project director, personnel director, quality control director, procurement director, comptroller, safety director, community relations director, industrial relations, design director, production director, human resources director, physical plant director, etc.
- Each student played one or more of the role positions in accordance with their interest or class election.
- The name selected by the class for their organization was Telespace Corporation.
- Each member of the class carried out their role functions as well as the constructional responsibilities assigned to them.
- The project director in the class chaired the daily meetings of the group which included reports of activities and progress from each of the management groups.


The group project
Class routine and procedures
General description and purposes
Selection of an industry
Criteria for industry selection
Personnel organization
Role identification
Role-playing
Resources
Tools
Materials
Project
Presentations
Displays
Publications
Exhibits
Behaviors
Generalizations
Skills
Information
Evaluation
Projection

The Group Project Educational Sequence


TSC
TELESPACE CORP.
BOARD of DIRECTORS
PRESIDENT
VICE PRESIDENT
QUALITY CONTROL
PROCUREMENT DIRECTOR
CONTROLLER
PHYSICAL PLANT DIRECTOR
INDUSTRIAL RELATIONS DIRECTOR
ADVERTISING
PLANT SECURITY
SAFETY DIRECTOR
COMMUNITY RELATIONS
PERSONNEL DIRECTOR
HUMAN RESOURCES AND DEVELOPMENT DIRECTOR
PROJECT DIRECTOR
PRODUCTION DIRECTOR
SUPERVISOR
DESIGN DIRECTOR
UNION STEWARD
LABOR FORCE

Telespace Project Personnel Chart

- The educational director was charged with developing and carrying out an educational program centering around the space industry as well as the general objectives for Industrial Arts Education. Such programs involved guest speakers, field trips, films, presentations by the students regarding their role functions in industry, and also selected presentations by the instructor as scheduled by the educational or human resource director.
- The production director assumed the responsibility to see that all of the necessary components were contracted out to the various students, and that the project moved along as scheduled.

The total operation was student conducted and managed. It is an excellent process for the development of such important personal qualities as leadership, followership, dependability, responsibility, and initiative. The process also provides many and diverse opportunities for developing problem-solving skills, communications capability, resourcefulness, and a strong sense of belonging. See Photo 3 for the personnel chart used in the Telespace Corporation Group Project.

This particular group project also stimulated a great deal of interest in the space programs as well as insights into the function, operation and responsibilities of the Goddard Space Flight Center. The personnel from the Goddard Center as well as their facilities were available when needed. The LST project also attracted a great deal of attention in the Industrial Education Department as well as in the broader University community.

The students in the practicum class were able to construct the needed display for NASA and at the same time construct a more complete model including the mirror sections for the Department of Industrial Education at the University. A special social event was planned for the occasion when the model would be presented to the Goddard personnel. This event was under the leadership and responsibility of the student Community Relations Director. The actual presentation by the class was made to Mr. Richard N. Crone and at least four scientists from the Goddard Space Flight Center (See Photo 4). This event was followed by an informal session with refreshments and an opportunity for the students to converse with the personnel from Goddard.

The total experience was one that took advantage of a popular and challenging opportunity—i.e., to be a part of something associated with one of the most exciting ventures of the period. The group project was a natural instructional strategy for meeting the needs of NASA and, at the same time, having the students involved in a rich educational experience that was aimed at developing the human qualities and characteristics, as well as the technical and management potentials of the students. The members of the class also had a first-hand experiential involvement with a strategy for teaching Industrial Arts/Technology Education that has few peers in the realm of group processes in education. That is actually the purpose for the practicum in Industrial Arts/Technology Education. It is a practical methods course that involved putting theory into practice and also having the future teacher actually experience the process in all its dimensions. See Photo 5 for a total class picture and partially completed mockup.

Dr. Donald Maley is Professor Emeritus at the University of Maryland, College Park, MD.

Richard Crone Educational Programs Officer at the Goddard Spaceflight Center Observes Assembly Operations in a Practicum Class Session

The Practicum Industrial Arts Class Assembled for a Class Picture with the Partially Completed Mockup

Directory of Authors

Aerospace Technology in the Elementary School
Terry Thode
Hemingway Elementary School
P.O. Box 298
Ketchum, ID 83340
208-726-3348

Aerospace Technology
Kenneth L. Smith
Charles County Public Schools
LaPlata, MD 20646

Satellites and Students, Today, Tomorrow and Technology
Margaret A. Rutherford
Howell Intermediate School
Route 2, Box 219
Goliad, TX 77963
512-578-1561

Technology Education, Reach for the Sky
Bruce M. Burwell
Crestwood Junior High School
Chesapeake, VA 23320

A Time for Change
Jerry Morlan
Frank Garside Junior High School
300 S. Torrey Pines Avenue
Las Vegas, NV 89107
702-799-4253

Aviation/Aerospace, A Program in Technology Education
John Blair
Herndon High School
700 Bennett Street
Herndon, VA 22070
703-437-6800

A School With a Mission
Fred Dull
Roscoe Schlachter
Lorain City Schools
Lorain, OH 44052
216-233-2200

Mark Emery
Southview High School
2270 East 42nd Street
Lorain, OH 44055
216-277-7271

Solar Energy and Robots in Technology Education
Dean Frame
Riverview Gardens High School
St. Louis County, MO 63155

Moonbase America
Carolyn Stoudt
Copley High School
3807 Ridgewood Road
Copley, OH 44321

Aerospace Education
Curt Olson
Sauk Rapids High School
901 First Street South
Sauk Rapids, MN 56379
612-253-4700

Aerospace, An Educational Catalyst
Jim Kyd
South Callaway High School
P.O. Box 37
Mokane, MO 65059
314-676-5211

Mission Control to Lunar Base
Craig Adams
Pat Daugherty
Rock Bridge High School
Columbia, MO 65201

The Central Project Model
L. Jerry Bernhardt
Larry J. McHaney
McCullough High School
Conroe, TX 77304

Shuttle Victoria
Bob Calhoun
Ashe County Career Center
P.O. Box 450
West Jefferson, NC 28694

Development of the Hubble Telescope Project
Donald Maley
University of Maryland
College Park, MD 20742
301-454-4264

INTERNATIONAL TECHNOLOGY EDUCATION ASSOCIATION

Aerospace Education Research Document

[Resolution C-90-1]

1990

Compiled by:
Rob Campbell
Idaho Supervisor for
Industrial Technology Education

International Technology Education Association

Aerospace Technology Survey and Related Activities

Foreword

ITEA President Donald P. Lauda requested that an ad hoc committee be formed to research educational space-related activities as they pertain to Resolution C-90-1 which states:

> RESOLVED, that the International Technology Education Association actively promote the development of space simulations by identifying model programs that promote space technology, and become an active participant in the International Space Year associated with NASA and the National Science Foundation and provide a space focus for a future ITEA conference.

This document is not a comprehensive list of every activity currently taking place. It is a compilation of the surveys returned before December 1, 1990. It will serve as an excellent resource guide for the implementation of Aerospace Technology-related activities at all educational levels.

The ITEA Board appreciates the support of the Idaho Division of Vocational Education and the hard work of Rob Campbell, group chairman.

Rob Campbell is a Supervisor for Industrial Technology Education in Idaho.

The State of Idaho, an equal opportunity employer, does not discriminate or deny services on the basis of race, color, national origin, sex, and/or handicap.

Section 1

NASA Services

NASA Educational Regional Resource Centers:

NASA Jet Propulsion Laboratory
Attn: Science & Mathematics
Teaching Resource Center
Mail Stop: 180-205
Pasadena, CA 91109
(818) 354-6916

NASA Lyndon B. Johnson Space Center
Attn: Teacher Resource Room
Mail Stop: AP-4
Houston, TX 77058
(713) 483-3455

NASA Langley Research Center
Attn: Langley Teacher Resource Center
Mail Stop: 164
Hampton, VA 23365-5225
(804) 865-4468

Alabama Space and Rocket Center
Attn: Teacher Resource Room
Tranquility Base
Huntsville, AL 35807
(205) 837-3400 Ext. 36

NASA George C. Marshall Space Flight Center
Marshall Space Flight Center, AL 35812

NASA Goddard Space Flight Center
Attn: Teacher Resource Laboratory
Mail Stop: 130-3
Greenbelt, MD 20771
(301) 344-8981

NASA John F. Kennedy Space Center
Attn: Educators Resource Laboratory
Mail Stop: ERL
Kennedy Space Center, FL 32899
(305) 867-4090

NASA Lewis Research Center
Attn: Teacher Resource Center
Mail Stop: 8-1
Cleveland, OH 44135
(216) 267-1187

NASA National Space Technologies Laboratories
Attn: Teacher Resource Center
Building 1200
NSTL, MS 39529
(601) 688-3338

NASA Lewis Research Center
2100 Brookpark Rd.
Cleveland, OH 44135

University Program Branch
Educational Affairs Division
Mail Code XEU, NASA Headquarters
Washington, D.C. 20546
(202) 453-8344

Project Title: Graduate Student Research Program

This program awards fellowships to graduate students whose research interests are compatible with NASA programs. Approximately 120 new awardees are selected each year based on a competitive evaluation of academic qualifications, the proposed research plan or plan of study, and where appropriate, the planned utilization of NASA research facilities. For further information contact the above address.

National Aeronautics and Space Administration
Educational Services
Washington, D.C. 20546

Project Title: Aerospace Education Mobile Unit

The project is a national program of free services to teachers, students, and the general public. The goal is to increase awareness and understanding of scientific research and technological development and its place in the world in which we live.

The NASA Aerospace Education Services Project provides the professional services of a specialist in aerospace education. These specialists are qualified educators who will travel to your area in a van or similar vehicle to your area and present workshops, seminars, conferences, curriculum planning and instructional materials. Teachers and student workshops emphasize the hands-on approach to teach the aerospace concepts. The auditorium demonstration-lecture program uses simple experiments and scale models of space harder to explain the basic scientific principles applied in the exploration of air and space.

To request a program or to learn more about NASA's Educational Services please contact the National Aeronautics and Space Administration for the NASA regional center in your area: (Ames, Goddard, Johnson, Kennedy, Langley, Lewis, Marshall or NSTL in Mississippi).

Educational Technology Branch
Educational Affairs Division
Code XE
NASA Headquarters
Washington, D.C. 20546
(202) 453-8344

Project Title: NASA Educational Satellite Video-conference Series and NASA Space Grant and Fellowship Program

Four 90-minute video-conferences will be delivered via satellite featuring program briefings by NASA project personnel and educational activities presented by specialists in aerospace education.

Highlights:

- Current presentations by NASA project personnel
- Innovative & exciting educational activities
- Publications & other materials for teacher-participants
- Opportunity for professional development for teachers
- Toll-free telephone interaction with speakers
- No cost

Registration:

Aerospace Education Services Program
Department of Aviation & Space Education
Oklahoma State University
300 North Cordell
Stillwater, OK 74078-0422
(405) 744-7015

A national Space Grant College and Fellowship program was mandated by Congress in 1987. NASA was charged with its implementation. The first phase of the program was to name schools or consortia as Designed Space Grant College Consortia. These designed institutions, which are already significantly involved in space-related activities, will receive grants and fellowships. The Designated Space Grant College Consortia will provide leadership and form partnerships with other universities, government, and industry to better understand, develop, and use space resources through research, education, and public service functions.

A list of Space Grant Colleges and Consortia can be obtained by contacting the University Programs Branch, NASA Headquarters. (Either address given above.)

Spacelink Administrator
Marshall Space Flight Center
Mail Code CA-20
Huntsville, AL 35807
(205) 544-6527

Project Title: Educational Technology Programs "SPACELINK"

Spacelink is an information access system that allows individuals to log on and receive news about current NASA programs and acclivities and other space-related information, including historical and astronaut data, lesson plans and classroom activities, and even entire publications. Although primarily intended as a resource for teachers, anyone with a personal computer and modem can access the network.

Spacelink Direct Dial via Modem:
(205) 985-0028
Data word format: 8 data bits, no parity, and 1 stop bit

Personnel Policy and Work Force Effectiveness Division
Mail Code NPM, NASA Headquarters
Washington, D.C. 20546
(202) 453-2603

Project Title: Cooperative Education Program

A NASA-wide program, the Cooperative Education Program gives high school, college, and graduate students an opportunity to work at a field center while completing their education. Each field center negotiates its own cooperative agreements with schools in its geographic area. Contact the Center Personnel Officer at the NASA field center that serves the school's geographic area, or contact the above address.

NASA
Educational Publications
Washington, D.C. 20546

Project Title: Educational Resources for all Educational Grade Levels

Section II

Organizations Supporting Aerospace Activities

Challenger Center
1101 King Street, Suite 190
Alexandria, VA 22314
(703) 683-9740

It is the spirit that the families of the 1986 Challenger Astronauts have developed and supported the concept of the Challenger Center for Space Science Education. The mission of the center is to fortify the basic American skill, which is solving problems. Thus, the Challenger Center has been conceived as a power that will serve our nation. Its purpose is to create a unique learning environment in which teachers learn to teach better and students learn to learn more fully the fundamental nature of math, science and technology, using the conditions of space as a motivator.

The Challenger Center has developed teaching scenarios that can be applied in almost any teaching environment. The series of innovative, multidisciplinary, easy-to-use classroom materials centering on space. Challenger Center materials will emphasize creative problem solving, critical thinking, simulation and cooperative learning.

Challenger Center's NASA trained Space Ambassadors and Regional Coordinators offer workshops in the use of Challenger Center materials and other related learning activities.

The Center also sponsors a teleconference series transmitted via satellite to hundreds of schools across the country.

For a $35.00 yearly membership fee, members receive publications, mailings, special curriculum packages as they are developed, and reduced registration fees for Challenger Center events.

The Center also promotes the use of a complex Space Station Simulation complete with Mission Controls and the actual Space Capsule. The system is designed to meet your particular space requirements and is delivered to you ready to go.

Challenger Center continued:

Project Title: Destination-Mars, ISY Project

Components

1. Baseline Program: (classroom-based) October '91–April '92
   Theme: Planning Marsville
   Projected: 125,000 youngsters in 5,000 classrooms
   - Student teams led by teacher/mentor
   - Simulation-based (four problem sets with accompanying material, Oct., Dec. 1991, Feb., April 1992)
   - Partnered with major educational publisher and/or international newspaper
2. Regional Conferences; (Challenger Learning Centers, NASA field centers, sciences museums/centers and/or Space Grant Consortia Universities) May '92
   Theme: Building Mars Habitat
   Projected: 10,000 youngsters at 100 sites
   - 1-day (late May)
   - Interactive video conference linking conference sites
   - Key activities
   - Sharing solutions to baseline problem sets
   - Lectures/demonstrations on space-related issues and concepts
   - Selection of representation to International Conference
   - Construction/model display of Martian Habitats
3. International Conference: (Kennedy Space Center) July '92
   Theme: Marsville—the Cosmic Village
   Projected: 250 participants (student-teacher teams of 5–7) at Kennedy Space Center
   - 4-days (mid-July)
   - Linkage with "Mission Sites" (regional conference sites) via interactive activities
   - Key activities
   - Speakers on space-related issues
   - Global Town Meeting (to create a Marsville governance structure)
   - Construction of prototype Marsville (integrating the habitats)

For more information concerning the activities of the Challenger Center, contact the above address.

National 4-H Council
7100 Connecticut Avenue
Chevy Chase, MD 20815

Project Title: Blue Sky Below My Feet

This project introduces 6–12 year olds to the world of science and technology using features from the Space Shuttle program as working models. Using the three different subject matter areas—force and gravity, fibers & textiles and food & nutrition.

Blue Sky is designed as a self-contained teaching/learning package with great flexibility to meet special needs and situations. The program consists of three half-hour television video/film programs which are supported by a Mission Manual for members, a Leader/Teacher Handbook and an extensive choice of learning activities for youth.

John Mosley
13623 Sylvan
Van Nuys, CA 91401

Project Title: Public Domain Astronomy Programs

Amateur astronomers and Technology teachers, would you like a great collection of astronomy software for your Apple II? John Mosely of the Griffith Observatory in Los Angeles has collected over 50 programs that fill three double-sided 5¼-inch disks.

Sample programs include:

- Astronomy Hangman
- Comet Position
- Eclipses
- Inner Planet Visibility
- Planet Finder
- Precession
- Telescope Math
- Time Dilation
- Twilight Times

All of the software is public domain, so it can be copied freely. To receive a set, send $10.00 (above address).

The planetarium also provides observations, hands-on museum, and public telescope observations. You can also call in (213) 663-8171 for a current Sky Report.

JETS, Inc.
1420 King Street
Suite 405
Alexandria, VA 22314-2715

Project Title: Engineering Series

The Junior Engineering Technical Society (JETS) is a national nonprofit educational organization dedicated to preparing precollege youth for the challenging world of tomorrow.

JETS has produced brochures describing various engineering disciplines or fields related to the engineering profession. One copy of the following three brochures can be obtained at no cost.

70Aero	Aerospace Engineering
90AeroET	Aeronautical Engineering Technology
CA-01	Within Your Lifetime, Careers in Aerospace

Request your copies by writing to the above address.

Wayne Calk
Supervisor, Industrial Technology
Ysleta Independent School District
9600 Sims Drive
El Paso, TX 79925-7225
(915) 595-5576, Ext. 734

Project Title: International Student Space Simulation (ISSS)

The mission scenario for students is to design, build operate and evaluate an International Space Station, along with mission control facilities, transportation vehicles, and many other component projects.

Goals for the mission have been established to parallel NASA's next big step, which is to establish a permanently manned orbiting space station. NASA's Space Station Freedom is being developed through cooperative efforts involving the United States National Aeronautic Space Administration, the Japanese Space Agency, and the European Space Agency and the Canadian Space Agency. With this focus on cooperation, Ysleta's mission will approach the same international involvement.

Four cooperative scenarios have been developed to allow students from participating nations to select the scenarios that best matches their resources and capabilities.

The Central Project (multidisciplinary approach) Model will be used to complete most of the related activities.

Student Space Station
Richard S. Knapp, Project Director
P.O. Box 22826
Jackson, MS 39225-2826
(601) 960-1550

Project Title: Student Space Station

Student Space Stations a project of the Davis Planetarium Foundation (private membership organization), with cosponsorship of the city of Jackson and Belhaven College.

Mississippi's Student Space Station project involves selected junior high aged youth in an intense 14-day science residency, during which each student undertakes research investigations in a field of science related to his/her own interests. A competitive selection process identifies students who think creatively about science and technology, and articulate their ideas well. The selected students spend 10 days of their residency planning and developing their research investigations, creating and testing their "flight experiments," learning computer skills, and becoming familiar with the systems and procedures of the mission simulators. The final days are devoted to a round the clock 96 hour simulation of a space station mission. Eight "Science Officers" man the space station "Athena" and perform the complement of 40–50 "flight experiments," while the remaining 24 youth man the Mission Control Center in shifts—directing flight operations, mission's schedule, and solving problems that occur. All participants learn that successful research and a successful mission involve teamwork, discipline, and responsibility, and that science and technology operate within the dictates and constraints of the real world.

The current tuition is $1,200.00 for the 14-day national mission.

The construction of the space station was largely due to the contributions of the Mississippi Council of Coca-Cola Bottlers.

Kalmbach Publishing Company
21027 Crossroads Circle
P.O. Box 1612
Waukesha, WI 53187-9950

Project Title: Odyssey Space Exploration Magazine

Odyssey is a magazine about astronomy and space exploration for kids from age 8 to 14. The magazine offers space-related articles and projects, as well as reader participation activities like: Question Column, Reader Opinion Column, "Space Mail," Reader Art, Poetry, and Astronomical Reports. The magazine also includes frequent space-related contents.

The magazine in vendors for software, videos and related teaching materials for space-related activities.

A free trial issue can be obtained by writing a request to the above address.

US International Space Year Association
600 Maryland Avenue SW
Suite 600
Washington, D.C. 20024
(202) 863-1734
Fax 202 863-5240
or
Sherri McGee
University Programs Branch
Educational Affairs Division
NASA Headquarters
Code XEU
Washington, D.C. 20546
(202) 453-8344

Project Title: ISY 1992/SAFISY

The 1985 United States Congress proposed an International Space Year (ISY) for 1992, commemorating the 500th anniversary of Columbus' voyage to the New World and the 35th anniversary of the International Geophysical Year that ushered in the space age.

President Reagan endorsed the ISY and reported to Congress that NASA had found worldwide support for an ISY in 1992, consisting of space activities coordinated on a global basis.

NASA through the Office of Space Science and Applications and the Division of International Relations, established the Space Agency Forum on ISY (SAFISY) to coordinate ISY planning, with a current worldwide membership of 28 national and eight international space agency/organizations. ISY is generating numerous educational activities, including classroom activities, films, television programs, that will greatly improve public understanding of the significance and potential of the space age.

In July, Congress passed and President Bush signed a joint resolution reaffirming support for ISY and calling for an expanded national commitment.

A list of SAFISY members may be obtained by requesting in writing, from the above address.

A chronology of events for the 1992 International Space Year is provided below.

1985	A Congressional resolution calling for a 1992 ISY passes unanimously in the U.S. House and Senate.
1986	President Reagan endorses ISY, calls on NASA to lead effort.
1986	NASA finds support from 23 nations for an ISY.
1986–87	Scientific organizations worldwide endorse ISY, set up committees to plan science activities.
1987	NASA supports creation of US-ISY as an information clearinghouse
1987	First ISY conference, Hawaii.
1988	25 space agencies from the "Space Agency Forum on ISY" (SAFISY) at New Hampshire meeting sponsored by NASA.
1989	First SAFISY summit, Italy.
1989	United Nations endorses ISY, plans program for developing nations.
1990	SAFISY panels meet in Austria and France to plan educational projects and review earth observing research.
1990	Congress reaffirms support for the ISY.
1990	Second SAFISY summit, Japan.

The US-ISY provides a variety of services related to International Space Year activities. Following are some additional services for educators:

1. ISY Information Service: distributes news releases and other informational materials to the media, targeted organizations and interested individuals.
2. ISY Clearinghouse: gathers information on ISY activities worldwide, publicizes those activities, and informs ISY participants of possible productive interactions.
3. ISY News; a newsletter published periodically.
4. ISY Conferences and seminars: designed primarily to carry the ISY message to the general public.

For more information, contact the above address.

USA Today
Ms. Nelwyn Moser
Educational Programs
USA Today
1000 Wilson Blvd.
Arlington, VA 22229
(703) 276-6362

Project Title: Visions of Exploration: Past, Present, Future

USA Today, in partnership with NASA, has developed "Vision of Exploration: Past, Present, Future." It will target students in grades 3–8 and will focus on science, math, technology and social studies. However, expression is encouraged in all disciplines, including reading, career education, music and art.

The program will examine how exploration has changed our planet, its impact on education, economics, science, and cultural awareness.

The goals of the Vision program are to:

a. Rekindle students' interest in science and space exploration and encourage students to explore the areas of science and math as career fields.
b. Identify role models for young people and help them set realistic goals for their dreams.
c. Teach basic skills and allow students to use technology in practical applications.
d. Establish lifelong habits of reading, sound decision making, and social participation.

e. Involve the student, school, family, and community in an active celebration of education.

Young Astronaut Council
1211 Connecticut Avenue
Suite 800
Washington, D.C. 20036
(202) 682-1985

Project Tile: Young Astronaut Program

The Young Astronaut Program is a national educational program for elementary and junior high students designed to promote the study of science, mathematics and school related subjects. Its primary purpose is to help reverse the low proficiency levels of graduating American students in these subjects compared with their peers in other industrialized countries.

The program was created by the White House Offices of Private Sector Initiatives and launched at the White House on October 17, 1984.

The core of the program is the development and distribution of original, high-quality, space-related, curricular materials and hands-on activities to member Chapters. Two–three hours per week of materials are supplied for an annual fee of $40.00 per Chapter.

The materials are developed for the Young Astronauts Council by aerospace specialists with the support of NASA and other loaned experts from industry and government.

The basic curriculum involves an Adventure Series of monthly scientific exercises for Trainees (grades 1–3), Pilots (grades 4–6), and Commanders (grades 7–9), together with Space Watch for monthly stargazing and stellar education.

Chapters participate in essay, art, math, and science competitions, both locally and nationally.

Youngstar Space Academy
James T. Giganti, Executive Director
11301 Georgia Ave., Suite 3
Silver Spring, MD 20902
(310) 946-1656

Project Title: Curriculum Courses and Summer Star Camp

The Youngstar Space Academy is dedicated to:

- Increasing knowledge of science and mathematics among America's youth.
- Creating a long-term enthusiasm for space and aviation among this target group.
- Providing educators with the training and tools to enable them to educate their students in space and technology.

The Youngstar Space Academy will develop and implement educational products and curricula that provide direct, hands-on exposure to aerospace and aviation for children at the primary and secondary levels. Youngstar will incorporate these products in its existing and expanded school based programs.

Youngstar offers a variety of programs to the school and students. They are separated into the following three categories:

1. Aerospace Science Courses: These courses are offered as an addition or alternate to the basic science course. They are designed for the first through 12 grades and range from three days to several months.

The high school level courses present materials on a multitude of subjects including astronomy, flight, aerodynamic principles, etc. Video education series and after school enrichment programs have been developed and implemented.

2. Aerospace Assembly Programs: The majority of presentations are given to schools an/or organizations as part of a scheduled "space" event or to introduce students to the program.
3. Aerospace Enrichment Programs: These courses are offered independently or as part of established "latchkley" programs. Enrichment courses run about an hour and a half, one day a week per school.
4. Star Camp: Star Camp is offered from the first week of summer vacation until mid-August. All the programs are space science related
5. Community: Community events include open houses, science fair competitions, education and space awareness programs, special events and theme parties.

Astronomical Society of the Pacific
Andrew Franknoi, Director
390 Ashton Avenue
San Francisco, CA 94112
(415) 337-1100

Project Title: Astronomical Organizations

The Astronomical Society of the Pacific is one of the leading astronomical organizations in the world, bringing together scientists, educators, hobbyists, and many thousands of others who are fascinated by the cosmos.

Founded in 1889, it is a nonprofit scientific and educational organization, dedicated to supporting astronomical research and to increasing the public understanding and appreciation of science. With members in every state of the Union and over 70 other countries, the Society is dedicated to sharing the excitement of astronomy and explaining new discovers and ideas about the cosmos in everyday language.

Mr. James M. Ferren
Project Director, Space Arc
Rochester Museum & Science Center
657 East Avenue, Box 1480
Rochester, N.Y. 14603-1480
(716) 271-4320

Project Title: Space Arc, Earth Orbit Archives

Space Arc is the ultimate time capsule: an archive of human thoughts, hopes and dreams that will be recorded on optical disks to be placed on board a satellite for launch into Earth orbit during 1992, the International Space Year.

This multidisciplinary educational project reflects humanity's ageless romance with space and our longing to communicate to the future.

Written by educators, the Space Arc program has been successfully field-tested in more than one hundred schools in the United States and with students in the Soviet Union.

Space Arc is not just the archive that will be placed in Earth orbit in 1992, but a series of classroom activities that produce the cargo for the satellite. Uniting technology with the humanities, the appeal of Space Arc lies in its flexibility; you and your students chart the best course for their adventure.

To obtain more information and the Space Arc Archival form, write to the above address.

National Headquarters
Civil Air Patrol
Maxwell AFB, AL 36112-5573

Project Title: Aerospace Education
The overall purpose of aerospace education is to communicate to the CAP membership and the educational community the knowledge, skills, and attitudes about aerospace activities and the total impact of air and space vehicle upon society. To accomplish this purpose, CAP has developed an INTERNAL and an EXTERNAL program.

The internal program provides aerospace education to the CAP membership—cadet and senior. The purpose of the CAP cadet program is to motivate American youth to develop leadership abilities and to become responsible citizens through aerospace education and aviation-centered activities.

The external program provides aerospace education to the general public through the CAP membership. There are over 200 CAP-affiliated aerospace education workshops conducted annually for teachers.

External staff members also promote aerospace education courses in local junior and senior high schools. The textbook AEROSPACE: THE CHALLENGE with Student Study Guide and Instructions Guide is designed to be used in a high school elective course. Junior high schools can use the text Horizons Unlimited in their aerospace education courses. Additionally, the brochure AEROSPACE EDUCATION TEACHING MATERIALS outlines many other CAP aerospace education resources that are available for teachers.

Materials can be ordered from the CAP bookstore:

CAP Bookstore
Maxwell AFB, AL 36112-5572
TOLL FREE NUMBER:
1-800-633-8768

For more information, contact the USAF-CIVIL AIR PATROL in your area:

Rocky Mountain Region:
Noel A. Bullock
Aerospace Education Director
USAF-CAP
DET 7 Building 407
Lowry AFB, CO 80230-5000
(303) 676-3082

Great Lakes Region:
Director of Aerospace Education
USAF-CAP
(MCLGLR), Bldg. 110
Wright-Patterson AFB, OH
45433-5000
(513) 257-6836

North Central Region:
Director of Aerospace Education
USAF-CAP
Bldg. 852, Mpls-St. Paul Intl. Airport
Minneapolis, MN 55450
(612) 725-5361

Northeast Region:
Director of Aerospace Education
Room 229, Bldg. 29-01
McGuire AFB, NJ 08641-5000
(609) 724-2967

Pacific Region:
Director or Aerospace Education
USAF-CAP
Bldg. 4579 (Base Ops)
Mather AFB, CA 95655-5000
(916) 364-2554

Middle East Region:
Director of Aerospace Education
USAF-CAP
Bldg. 3717, Stop 202
Andrews AFB, MD 20331-5000
(301) 981-6229

Southeast Region:
Director of Aerospace Education
USAF-CAP
Bldg. 802
Dobbins AFB, GA 30069-5000
(404) 429-5269

Southwest Region:
Director of Aerospace Education
P.O. Box 55
NAS Dallas, TX 75211-9505
(214) 264-2353

Christopher Columbus Quincentenary Jubilee Commission
Mr. Robin R. Rusczak
1801 F Street, NW, 3rd Floor
Washington, D.C. 20006
(202) 632-1992
(202) 523-9254 Fax

Project Title: Columbus 500 Space Sail Cup
The Space Sail Cup is an innovative international project of university led teams who will design, develop, and launch interplanetary spacecraft powered exclusively by the energy of the Sun. The competition currently involves twelve teams from eight countries, including the United States, Italy, China, England, Canada, the USSR, Japan, and Israel.

The Columbus 500 Space Sail project will organize the launch of at least three Solar Sails by 1992—the "Nina," "Pina," "Santa Maria"—to journey from High Earth Orbit (HEO) into interplanetary space toward Mars. The three vessels will be chosen in worldwide competition by the Columbus 500 Space Sail Committee.

A major thrust of the Space Sail competition is to stimulate interest in scientific education, space exploration, and to demonstrate the importance of a solid national technological foundation.

For more information, please contact the above address.

Environmental Research Institute of Michigan (ERIM) and the National Aeronautics and Space Administration (NASA) Contact:

Mr. Buzz Selman
ERIM-STEP
1975 Green Road
Ann Arbor, MI 48105
(313) 994-1200, Ext. 3236

Project Title: Space Technology Education Program (STEP)

STEP represents a commitment to implement programs that will foster significant and measurable improvements in the quality of secondary and university education through the appropriate use of contemporary technologies. These include the technologies of telecommunications, computer-aided instruction, and remote sensing. The underlying premise of STEP's structure is that teachers must be shown that contemporary technologies are ready for classroom use, since teachers are the primary transfer agents for skill development and knowledge building among their students.

STEP 1—The Direct Readout Program is a NASA-funded endeavor to demonstrate to teachers throughout the United States how they can bring pictures from the National Oceanic and Atmospheric Administration's (NOAA) operational environmental satellites directly into their classroom. This picture reception capability can be used both to support existing curricula and as a point of departure for introducing new methods and content into the classroom. The STEP-1 program has three interrelated tasks:

1. STEP summer workshops are offered to explain to the participating teachers both the pedagogical and technical challenges involved in successfully starting a direct readout program in their schools.
2. A STEP clearinghouse has been established at ERIM to provide continuing support to teachers who start local programs, and to network individual school programs across the United States to share curriculum ideas that are working well in existing classrooms.
3. The STEP Program will help develop new curriculum materials and "test market" these in schools which are participating in the program. Interested teachers should write to the address listed above for information about the STEP Direct Readout workshops.

Institute for Security and Cooperation in Outer Space (ISCOS)
Mr. Tom Cremins
8 Logan Circle, NW
Washington, D.C. 20005-3727
(202) 462-8886

Project Title: Spaceship Earth Teaching Classroom Project

Using this primary school teaching module, students and their teachers design their classrooms as a spaceship/colony. Each student decides upon an area he/she would like to develop (e.g. agriculture, engineer, astronomer, etc.). All students operate the spaceship, becoming aware of their dependence on one another. Other subject areas such as health and nutrition can also be incorporated into the module. ISCOS plans to establish test classrooms in selected states in 1990 with the introduction of the program nationally in 1991–1992.

National Air and Space Museum
Mr. Brian Duff
National Air and Space Museum
Smithsonian Institution
P-700
Washington, D.C. 20560

Project Title 1: "Blue Planet"

Scheduled to premiere at the museum in December, 1990, the "Blue Planet" will combine scenes shot by the astronauts in space with segments shot on Earth, from aircraft, and with data from orbiting satellites, on the sea floor, and using computer graphics. The film will focus on the beauty of the Earth, the delicacy of the environmental systems, and how they are changing.

Project Title 2: "To the Stars"

Scheduled to premiere in early 1992,"To the Stars" (working title), turns the camera to the cosmos. Through the observations of Galileo, the Hubble Space Telescope, Voyager, and Earth-based installations, we are afforded a big-screen visit to Jupiter, Mars, Neptune, and beyond. The film will explore the wonders of space, black holes, supernova and the neutrinos that they produced, and other cosmic phenomena.

Project Title 3: "Where Next Columbus?"

In February 1992, the National Air and Space Museum will open an exhibition that marks the 500th anniversary of the first exploratory voyage of Christopher Columbus across the Atlantic Ocean to the "New World." Entitled "Where Next Columbus" the exhibit will examine our prospects during the next 500 years, for discovery and exploration of new worlds in space.

National Oceanic and Atmospheric Administration
Mr. Douglas L. Brown
Chief, Educational Services
NOAA
1825 Connecticut Ave., NW
Washington, D.C. 20235
(202) 763-4690

Project Title: ISY Educational Activities

NOAA's ISY initiatives are keyed to environmental satellites operated by the U.S. and other countries, and new methods of data storage retrieval and display. The agency's plans for ISY include: leading an international effort to develop a directory for earth observation in education; contributing laser optical techniques in textbooks and electronic systems for science education; and sharing data sets of resource materials for science teachers. In addition, NOAA will participate in the NSTA sponsored SOAR conference in 1992.

The project to develop a directory of resources for earth observation in education will result in a comprehensive listing of information pertaining to the classroom use of remote sensing technologies. Satellites offer an excellent opportunity to bring the high technology of remote sensing into the classroom. In particular, the technology of direct broadcast from weather satellites has a broad range of application in the educational community, from serving as a visual aid in a classroom, to a "hands-on tool for smaller groups engaged in projects, lab work or "club" activities. School programs which promote and nurture the use of weather satellite technology exist today, on a limited basis, in the United States, France and the United Kingdom. In some cases, technical materials and lesson plans have been developed by these schools to assist other teachers in building a station and integrating the imagery from it into their class curricula. However, there exists no single source document to which educators can refer in seeking information or assistance in establishing a remote sensing program in their school. The purpose of the directory is to close this information gap. By providing a list of schools using weather satellite technology, lesson plans and curriculum guidelines, equipment manufacturers, teacher training opportunities, and technical references, educators around the world will have a source document on classroom use of remote sensing.

It is important that the directory be published in several languages. NOAA will seek assistance from other SAFISY members in producing and distributing non-English versions of the directory. Plans are to distribute the directory at regular intervals thereafter.

National Science Foundation
Dr. Arnold A Strassenburg
Director, Division of Materials Development, Research and Informal Science Education
Directorate for Science and Engineering Education
National Science Foundation
Washington, D.C. 20550

Project Title: Science and Engineering Education Programs

The National Science Foundation provides awards for education and research in the sciences, mathematics, and engineering. The Foundation welcomes proposals from all qualified educators, scientists, mathematicians, and engineers, and strongly encourages women, minorities and physically disabled to compete fully in its programs. The Directorate for Science and Engineering has a number of programs that have goals consistent with those of ISY. The following is a listing of some of those programs.

1. **Teacher Enhancement.** Supports in-service teacher education projects. Favors projects that emphasize content and hands-on activities, and those that are long enough to make a real difference in the capabilities of the participants. A two-week institute on the physics of space travel would be appealing to many middle school science teachers.
2. **Presidential Awards.** This is a teacher recognition program. The 500 plus teachers who have received this recognition are a resource, because of their excellence as teachers and because they are committed to public service that is directed toward improving science and mathematics education.
3. **Instructional Materials Development.** Supports the development of all kinds of materials for the teaching of science and mathematics, grades K–12. A module treating the physical, biological, and psychological problems associated with space travel aimed at ninth grade students is one of many possibilities. Proposal success would depend in part on involving competent scientists in the creative work and including a promising dissemination plan.
4. **Informal Science Education.** Supports television programming, museum exhibits and club activities. Each of these offers possibilities. A proposal to produce a high quality, high impact TV special would be welcome. Museums should be encouraged to offer special exhibits on space. Four H clubs, Boy Scouts, and Girl Scouts could develop new space-related educational activities for ISY.
5. **Faculty Enhancement.** Supports continuing educational opportunities for science, engineering, and mathematics faculty form colleges and universities that are not on the research frontier. A college-level version of the institute described above under Teacher Enhancement would be appropriate.
6. **Young Scholars.** Support enrichment programs for promising junior and senior high school science students. Summer programs at NASA facilities would have strong appeal.

National Science Teachers Association
Mr. Bill G. Aldridge
Executive Director
NSTA
1742 Connecticut Avenue, NW
Washington, D.C. 20009
(202) 328-5800

Project Title: ISY Edition of Quantum

Quantum is a joint publication with the USSR Academy of Sciences and the USA NSTA, first published in January, 1990 in the U.S. It is a magazine for students with articles by leading scientists and mathematicians.

In early 1992, a special ISY edition will be published that focuses on space sciences. It will be an issue of 200–300 pages in length with advertisements from space-related industries and fromcolleges and universities, and articles by the best scientists throughout the world. The articles would be aimed at students, ages 14–18. Other content could include notices of exchanges, competitions, and ISY related programs. There will also be a section on resources for students, including print, film, tape and computer software products.

It is hoped that this special edition of Quantum will stimulate student interest in science at the secondary and university levels and serve as a valuable resource and inspiration for students.

World Timecapsule Fund
Mr. Charles S. Smith
President
The World Timecapsule Fund
3300 Louisiana Ave., So., Suite 415
Minneapolis, MN 55426
(612) 935-1206

Project Title: World Timecapsule

The World Timecapsule is an international project which will collect, preserve and share a unique story about humanity. It will consist of written, visual and auditory information provided by individuals around the world to share the knowledge and experiences of their lives. The finished time capsule will be digitally recorded, with copies made available for public edification, preserved for posterity, and sent into outer space in the Year 2000.

As an educational tool, the project provides teachers a versatile and powerful means of curriculum enrichment for all subject areas and grade levels. Through the project, students are presented with a stimulating intellectual challenge, inspired to explore topics more deeply and thus gain a greater understanding and appreciation of their particular subject matter. Most importantly they examine their own personal values, exploring emotional, social and future concerns while increasing their awareness and sensitivity toward the global community of which they are a part.

Teachers design their own specific application for utilizing the project to best meet their particular needs. Participating schools receive the necessary materials to implement a program, including student guidebooks and a video presentation to help introduce the concept in the classroom, and a teacher's guide providing ideas and instructions. The project offers an extraordinary opportunity for students to have their work preserved and communicated to the future, and sent into outer space.

Participation in the World Timecapsule offers a wonderful opportunity to captivate the attention and fire the imagination of students. It facilitates an exploration of value concepts, encouraging study beyond the usual curricular levels, and ultimately enlightens young minds.

WQED/Pittsburgh
Mr. Gregory P. Andorfer
Vice President, National Programming
WQED/Pittsburgh
4802 Fifth Avenue
Pittsburgh, PA 15213
or
Ms. Barbara Valentino
National Academy of Sciences
2101 Constitution Ave., NW
Washington, D.C. 20418
(202) 334-2782

Project Title: SPACE AGE

WQED/Pittsburgh, in association with the National Academy of Sciences, will mark the broad endeavor of ISY with SPACE AGE, a major new prime-time series for public television to premiere in early 1992. The series will reflect the international aspect of the ISY effort and the growing interest among those worldwide to work together; it will not report on American efforts alone.

The focus is not only international, but multidisciplinary and multifaceted. The series is being developed to see how space science and exploration reflect and also shape our culture, our economic fabric, our political and military environment, the state of global relations; how they have driven much of the "Information Age" and even the "Computer Age." The programs will involve social sciences as well as physical and biological science, technology, mathematics and engineering. The perspective of SPACE AGE will include the human side of exploration and the ramifications of research that affect all of us on the planet.

It is hoped that the series will stimulate a thirst for more information, especially among younger viewers. SPACE AGE will cover disciplines that have not been prominent in other series: physics, mathematics, engineering, and the important role of technicians in these large-scale endeavors. It will show the relationship between these disciplines and psychology, sociology and history. It is hoped that these programs and their companion educational materials will work to help alleviate the alarming shortage of science and engineering talent predicted for the United States over the next 20 years.

Space, Science, & Technology
National Science Teachers Association
Dr. Helenmarie Hofman
5110 Roanoke Pl., Suite 101
College Park, MD 20740

Project Title: Special Opportunities for Aerospace Resources

SOAR is a forum for classroom teachers, which hosts aerospace-related conferences. NASA, NOAA, ISY, Challenger Center, and more aerospace community members participate in the general sessions. SOAR Conferences are sponsored by the Space Science, and Technology Division of the National Science Teachers Association.

For conference dates and locations, contact Dr. Hofman.

ISSS
% Jerry Bernhardt and Larry McHaney
3800 South Panther Creek Drive
Woodlands, TX 77380
(713) 367-1025

Project Title: International Student Space Simulation

ISSS is a non-profit organization formed to promote one of the most dynamic, exciting and powerful teaching tools ever conceived. ISSS combines the universal appeal of space with current educational theory to create an interdisciplinary, activity based, problem solving program which challenges student's abilities and fuels their imaginations. Students are asked to research, design and build a simulated space habitation and all necessary life support sytems, vehicles and communication systems to then carry out a simulated mission.

Mission goals have been developed to include schools around the world, paralleling NASA's development of the International Space Station.

During the 72 hour mission, student astronauts will live in the space station simulator and conduct experiments and other space-related activities. Students will simulate actual space flight and orbit using computer programs.

Membership is issued through a school chartering process. Annual charter fee costs $100.000 (U.S.) with individual student membership of $3.00. Member becomes a part of an international network, which includes interdisciplinary space simulation activity guide, yearly mission scenarios, access to space student exchange network, ISS newsletter subscription, certificate of participation and catalog of ISS products and services.

AEROSPACE EDUCATION SYMPOSIUM
Noel Bullock
RDAE USAF/CAP Dept. 7
Bldg. 407
Lowry AFB, CO 80230-5000
(303) 676-3082 or (303) 926-3075

Project Title: Aerospace Education Symposium

Annually, a symposium is designed to acquaint participants with current aerospace education programs from kindergarten through university levels. Educators, Civil Air Patrol Senior Members, and other qualified facilitators are encouraged to attend. The symposium offers graduate credit. An average registration fee is $40.00, which includes two lunches, a reception, and the symposium materials.

Sample topics include:

Aerospace Education
National Aeronautics
Aviation Art
ROTC Programs
Kites and Education
Aircraft Models
Model Rocketry
Wings of Fame

Federal Aviation Administration Educational Programs.

The CAP Bookstore also offers several educational publications. Single copies are provided free. To request a current catalog/list and information on the next Symposium write to the above address.

Susan Lendorth, Communications Manager
The Planetary Society
65 North Catalina Avenue
Pasadena, CA 91106

Project Title: Miscellaneous Activities

Carl Sagan, Bruce Murray and Louis Friedman founded The Planetary Society in 1980 as a non-profit organization whose members share the goals of encouraging the exploration of the solar system and continuing the search for extraterrestrial life. With over 125,000 members in more than 100 countries, the Society is the largest space interest group in the world.

The Planetary Society (TPS) is working on the development of the Mars Balloon Tests under the direction of the French space agency, the Centre National d'Etudes Spatiale (CNES); the Space Research Institute (IKI) of the USSR Academy of Sciences; and the USSR's Babkin Center of the Lavotchkin Industry Association.

The involvement of TPS as a private, non-governmental organization in a planetary expedition is unprecedented in the history of space exploration.

A high-tech update of a centuries-old concept, the Mars Balloon combines the consistent buoyancy of gas balloon with the ascent and descent capability of a hot-air balloon heated by the Sun during the martian day.

The Society offers many classroom activities for grades K-12. Examples include:

Comparing Earth's Air and Oxygen
Observing the Effects of Air Pressure
Air Pollution
Model Spacecraft
Erosion in the Carbon Cycle

for more information and updates, contact the above address.

EAA Aviation Foundation
Chuck Larsen, Education Director
P.O. Box 3065
Oshkosh, WI 54903-3065
(414) 426-4888

Project Title: EAA Gateway to Aviation Activities and Careers.

EAA and the EAA Aviation Foundation offer a variety of programs for the adult aviation enthusiast of today plus exciting programs and activities for youth based on the EAA traditions of friendship, camaraderie and quality without compromise.

The EAA Aviation Center in Oshkosh, Wisconsin is the focal point for these activities and a growing outreach program offers activities at locations across the United States and Canada.

Youth membership is open to boys or girls who have not yet celebrated their 19th birthday. EAA activities include:

Youth membership
Project Schoolflight
Scholarship Program
Air Academy
Air Adventure Days
Outreach Activities

EAA provides several excellent aviation/aerospace activities for students. These activities include building flight simulators/trainers, Control Surface demonstrations, wood rib building, and hot air balloons.

Aviation Careers Unlimited
5529 Newton Avenue South
Minneapolis, MN 55419
(612) 926-6971

Project Title: Careers in Aviation

Bob Palmby, the producer, is no stranger to aviation. He has been a pilot since 1956, was an FFA tower chief and air controller for 31 years, is a professional speaker, and is a national recognized aviation career expert. He has presented numerous aviation related workshop and career.

Information sessions to high school students. His slide presentation has been viewed by over 18,000 high school students. Due to the overwhelming response, he has converted it over to a video format. A copy of the Careers in Aviation video can be obtained ($49.95) by contacting the above address.

Additional publications include:

Collegiate Aviation Directory, Professional Pilot Career Planning Guide, Flight Attendants Career Planning Guide, and Speaker Kit.

Feel free to contact Bob if you feel a complete career workshop is more in tune with your individual needs.

Section III

Educational Activities

Myra Halpin and Associates
605 Hammond Street
Durham, NC 27704
(919) 477-2418

Project Title: Teachers Touching The Future

Scientific Research: A Student Guide appropriate for middle school and high school students. The basics of scientific research are explained for the novice and experienced researches may find the data analysis and techniques for the paper and presentation helpful. Teaches Edition $8.95

Scientific Research; Statistical Analysis Module appropriate for advanced middle school students. Tutorial documentation may be used individually or as a class. Includes diskette, binder, 88 page documentation, 26 pages of sample problems, and two flow charts. Available in Apple or IBM. $49.95

Project Title: Space Activities

Enterprise and Beyond—K–12, contains construction instructions, experiments, general information about life aboard the shuttle, three mission sequence scripts, aids for speaking the NASA language, Mission control roles, and other suggestions for simulated missions. $12.95

Space Shuttle Kit, includes materials for building a ½ scale shuttle cabin inflatable, 12 ft. long and aft cabin wall 7 ft. tall. Inflates in 45 seconds by floor fan. Students climb inside and simualte missions. $49.95

Slides and script, 54 slides with script, project slides on aft cabin wall to give the illusion of looking out the window at astronauts working outside the shuttle, earth below, or CRT monitor. Diffusion sheeting for projection of slides is also available. $49.95

Cassette, tape of script a with sound effects. $9.95

EVA suit, white coveralls to use outside shuttle (middle school size and up—smaller students can make their own from garbage bags. $8.95

Toys in Space, toys used by astronauts on flight 51-D (make your own paper airplane.) $29.95

Toys in Space Video, This is a third generation copy of a NASA tape. $12.95

Mars One Crew Manual, a ballentine book by Kerry Joels. $12.99

The GAme of Space, each players goal is to be first to spell the word "SPACE" correctly answering on question in each of five categories, (Stars, Planets, Astronomy, Constellations, and Exploration. Special die is used to decide on categories. Designed by fourth grade teacher, Lynwood Winter. $8.95

Dr. Stephanie M. Gerjovich-Wright
5 Essex Drive
Bear, DE 19701

Project Title: Reach for the Stars

As the Aerospace Resource Educator, Stephanie has developed a college course. The course will begin with a history and an update of the Teacher in Space Program. Background and materials will be given on the Manned Space program, Moon Rocks,Toys in Space, the Space Transportation System, Spinoffs and beyond. Materials and NASA references and bibliographies will be distributed.

General Course Objectives

- To gain insight into the Teacher in Space Program.
- To be familiar with Aerospace organizations and materials.
- To learn and/or review the following:
  - Manned Space Program
  - Planetary Geology
  - Space Tansportation
  - Toys in Space
  - U.S. Space Program, The Next Fifty Years
- To design an aerospace lesson appropriate to grade level.

Sue Ellen Darnell
Space Education Coordinator
Kentucky Department of Education
1807 Capitol Plaza Tower
Frankfort, KY 40601
(502) 564-2106

Project Title: Kentucky's Space Education Program

The principle intent of the Kentucky Space Education Program is to provide staff development opportunities, motivational student programs and resource support to school districts across the state in the integration of space education across the disciplines.

Participants in this project offer districts the opportuity to simulate their students and teachers with this high interest, multidisciplinary earning experience that sparks the imagination and stirs the ambitions of all involved.

Title II funds are being used to support the staff and student developed program through a cooperative effort of the Paducah Independent Schools and the Kentucky Department of Education.

Sue organizes workshops at various sites as interest, planning and funding dictate.

The main objectives are as follows:

- Provide staff development opportunities.
- Motivate teachers and students about science, technology and related careers.
- Assist school districts in incorporating space education into their existing curriculum structure.
- Enhance instruction in all curriculum areas by helping school districts implement space education resources and related teaching methods.

For more information, contact Sue Ellen Darnell.

Dr. Kenneth W. Pool
Director, Graduate Studies in Education
Berry College, Box 5019
Mt. Berry, GA 30149-5019
(404) 236-2202

Project Title: Aerospace Activities and Workshops

Dr. Pool has organized several aerospace-related activities that can be used in almost any classroom. He provides hands-on workshops which include one week of NASA presentations and one week of local resource ifnormation. Participants take a field trip to the Huntsville Rocket Museum, Chattanooga Airport and Kennedy Space Center.

For more information, please feel free to contact him directly.

Art Kimura, Space Education Teacher
Aerospace Education Progam
DBED&T
P.O. Box 5814
Hilo, HI 96720
(808) 933-4741

Project Title: Today, Tomorrow and the Future

Art has presented 90 minute sessions to one hundred fifteen thousand students in grades K-12, and numerous Challenger Center workshops for teachers. Throughout the 1990–91 year he will be sponsoring Space Conferences, using the Return to the Moon, Apollo: the Next Generation formats. The activities include training and mission culminating in a bus landing on a lava field moon base. Future flight plans call for a space camp in Hawaii, July 7–19; each session lasting five days; meals, housing and programs will be conducted at the University of Hawaii at Hilo.

Additional activities include setting up a space education teacher resource center, Hilo International Airport, updating space education bulletin boards provided through the distance learning office in Honolulu, Hawaii.

For further information, please feel free to contact Art Kimura.

John Rossie
Director Aerospace Educational Development Program
6991 S. Madison Way
Littleton, CO 80122
(303) 694-6836

Project Title: Aerospace Educational Programsà

John worked with and sponsored several Aerospace Education workshops designed to enhance Aerospace Education skills. He has puablished two handbooks for Aerospace Education.

1. Resources and Ideas, 1989
2. Projects and Applications, Nov. 1990

His materials can be used at any grade level and has a multidisciplinary approach.

South Dade Senior High School
Steven A. Bachmeyer, Department Chairperson
Technology Education Department
28401 S.W. 167 Avenue
Homestead, FL 33030
(305) 247-4244, Ext. 285

Project Title: Aerospace Curriculum for Technology Education

Steven is currently developing a 36 week course for senior high school (10–12). As part of this curriculum development, he and his students are designing "hands-on" activities. Examples of the activities include:

Design and Recency.
Living In Space.
Metric Glider, currently being tested as one of the TSA national events.
The Komoto Flyer, revised from Dr. George O'Neel's original activity.

A complete curriculum/activity package will be available through PITSCO in Pittsburgh, Kansas early next year.

Copley High School
Carolyn J. Staudt, Director
3807 Ridgewood Road
Copley, OH 44321
(216) 666-5015

Project Title: Moonbase America

In recognition of 1992 as the International Year of Space, MOONBASE AMERICA will provide students throughout the nation the opportunity to participate in a national educational project. Levels of involvement are varied, but all those who commit to the project will benefit from its unique perspective on learning.

Student participants from Copley High School and Copley-Fairlawn Middle School will organize, assist in construction, and perform all needed preparations for a self-enclosed city in which eighty-four students will live for seven days. During this time, seventeen students will man the Command Center outside the structure. The project will incorporate many fields of study: Science, Computers, Electronics, Math, English, History and Government, Restaurant Management, Business, Physical Education, Speech, Communication, Technology, Music, Library Science, and Foreign Languages.

The most exciting part of this project is that it will be networked throughout each of the 50 states.

Major components or stations within the system include: hydroponics, fish hatchery, technology, government, energy/waste management, robotics, space science experiments and space science medicine.

The national curriculum will be developed through the support of nationally recognized high school and college instructors. The project officially began June 1, 1990.

The basic structure (city) is composed of one 50′ diameter dome connected by corridors to eight 25′ diameter offshoot pods. Two of the pods are reserved for sleeping quarters, while the others will be devoted to the experimental stations previously mentioned.

The curriculum guide will be distributed to interested teachers.

Lorain City Schools
Administration Office
1020 Seventh Street
Lorain, Oh 44052-1493

Project Title: Future

The Future (Further Understanding of Technology Using Realistic Experiences) is being jointly developed by NASA and Lorain City Schools to lead students into the world of technology. The program will use simulations of NASA space exploration missions to help students experience and understand technology.

The Future project will act as a catalyst to foster interest in science, math and technology. Related units of instruction will be developed to coordinate Future activities with related instruction taking place in academic classes. Students from academic classes and various grade levels may participate as an astronaut in the mission simulation.

Practical applications will include word processing data bases, spreadsheets, programming, CAD, and animated graphics.

The first phase of the Future program to be implemented was part of the Science, Math, Arts, and Technology Magnet.

Lowell Elementary, Whittier Middle School and Southview High School are all working together within the district to complete the program.

Orbital Space Station Mission at Southview High School is made up of three basic stations or centers.

1. The Research Center/classroom lab, will be adapted to the needs of the research and development teams.
2. Control Center/classroom, will be outfitted with a computer network. Advanced Communication students will develop all of the graphics to be displayed in the mission simulations. This room will also act as the mission control center for the space station.
3. Orbital Space Station Simulator will be semi-mobile. It will be a self-contained living quarters with provision for research experiementation and communication. Some missions will go around the clock for 48–72 hour period.

An amazing degree of realism was achieved in their creation. Working with students labeled as 'At-Risk" by most educators, the instructor was able to inspire the predominately "minority" students to complete a technical accomplishment far beyond their perceived abilities.

Lunar Surface Base Station Mission at Whittier Middle School is also made up of three district components.

1. Whittier Mission Control Center/technology computer lab, will be remodeled to simulate a mission control center.
2. Communications Center/the current Technology computer lab will be converted to serve two purposes. First, to serve as a communications/broadcasting center. Secondly, to house the Lunar Surface Base Station Simulator. In-house broadcast production will be ongoing with regular broadcasts aired on the Lorain Education Channel on the Lorain Cable Television Network.
3. Lunar Surface Base Station Simulator/this simulator housed within the current activity area of the technology lab will be built from the model designed by the Challenger Center for Space Education. Included in the simulation will be the Lunar Rover Module and several research oriented activities stations.

CORE
Lorain County JVS
15181 Route 58 South
Oberlin, OH 44074

Project Title: Educational Media

CORE, the Central Operation of Resources for Educators, is jointly supported by the NASA and the Lorain County Joint Vocational School in Oberlin, Ohio.

Core was established for the national and international distribution of NASA produced educational materials in audiovisual format.

Educational materials available include videotape programs, slide and film strip programs that chronicle NASA's state-of-the-art research and technology. Through the use of these curriculum supplement materials teachers can provide their students with the latest in aerospace information. There is a minimal charge for most audiovisual materials.

Doug Craig
Technology Education
Franklin Community High School
Grizzly Cub Drive
Franklin, IN 46131
(317) 736-6188

Project Title: R&D Spaceflight Simulation

Doug's program is quite diversified. Some of the activities students participate in are actual flight of an airplane, flight simulator, rocket design and testing, working in a 50 foot multiaxis snorkel, isolation chamber, and weightlessness, using underwater scuba gear.

During 72 hour live-in sessions inside a simulated space capsule, student astronauts contact a variety of space-related experiments.

The course is intended to allow students activities relating to space history, exploration, design, propulsion, aerodynamics, robotics, communication and construction, research and medicine. Laboratory research activities include lasers, hydroponics, geology, chemistry, and aerospace physiology.

Robert Mellette
Betsy Ross Arts Magnet School
185 Barnes Avenue
New Haven, CT 06513
(203) 787-8974

Project Title: Space Shuttle Science
This project is multidisciplinary in approach and was originally designed for use in grades seven and eight. However, it can easily be adapted to higher or lower grade levels.

The curriculum unit is designed to use the Space Shuttle as a "vehicle" to help students investigate basic concepts in Environmental and Physical Science.

The basic strategy of this program is to focus student attention on the life support system of the space shuttle. The introduction of scientific concepts follows a logical progression of a typical Shuttle mission from lift-off to landing.

Lynn Bondurant
Educational Services
NASA Lewis Research Center
Mail Stop 8–1
Cleveland, OH 44135

Project Title: Launching A Dream
Lynn was the Director of Education Research at the Lewis Research Center in Cleveland. His project involved several elementary and secondary schools around the Cleveland area.

School buses were converted over to simulated shuttles. Each school traveled to another school to share experiences. The entire event was scheduled so that each school would be traveling at about the same time.

The converted buses were equipped with computers, two-way radios, simulated instrument panels and various space-related experiment stations.

Lynn has compiled an excellent Teachers guide providing instructions and suggestions in getting started, preflight preparations, flight day, postflight activities.

Order the Launching A Dream Guide from:

NASA
Lewis Research Center
Cleveland, OH 44135

Neil Armstrong Middle School
℅ Bert Diamond, Co-director
Space Education
177 Mt. View Lane
Forest Grove, OR 97223
(503) 356-6171

Project Title: Forest Grove Space Education Program
The space education program involves a district wide approach. Student opportunities will be opened to possibilities that are far reaching, to explore with a high level of curiosity, and to develop and keep a dream of their future involvement in our planet's space efforts.

Through an understanding of the history and physics of flight, and through in-class simulations of space shuttle preparation, the student will build confidence and success that they can use now and in the future as astronauts, scientists, engineers, and technicians.

Program Description

Part I
Echo Shaw Elementary School (Shannon Brown, fifth Grade Teacher)

Students, teachers, parents, and community volunteers will join together to prepare and implement a space flight. Students study aerodynamics and history of flight and volunteer for specific jobs needed to outline and conduct the flight.

After four weeks of planning, designing and building the flight preparation equipment, a space shuttle in the form of a remodeled school bus will be launched. During the mission the (Eagle II) bus will explore the outer reaches of the community, while completing experiments.

The elementary component of the total mission will blend into the fifth grade curriculum while integrating space science with writing, reading, math, and art lessons.

Part II
Neil Armstrong Middle School (Bert Diamond, Technology Teacher)

The Middle School serves as the training center and actual space station/rendezvous/docking point for the echo Shaw Elementary spacecraft.

Middle School students designed and constructed a space station, simulating an orbiting space habitat. Students studied biology, physics, and technology concepts related to orbital living. Training equipment was also build by the students. Sample equipment include a spinning platform and gravity vests. Equipment will test vertigo, coordination, and balance under unusual conditions.

Part III
Forest Grove High School (Mike Fitzgibbons, Physics Teacher)

Physics students designed and built space-related experiments for use by themselves and Echo Elementary students during the three hour live in. High school students also helped train the students in the proper use of the equipment and basic procedures of the activities.

Basic Program curriculum:

Echo Elementary:

1. A study of aerodynamics.
2. A study of the history of flight.
3. Space shuttle preparation activities.
4. School Space day with the shuttle flight.

Neil Armstrong Middle:

1. A study of human biology and physics concepts related to space technology.
2. Design, build and use the testing and training equipment.
3. Analyze and compare results of young astronauts and other students as they train on equipment.
4. School Space Day with assembly

Forest Grove High:

1. A study of physics concepts related to space experiments.
2. Design, build, and test space science experiments.
3. Train young astronauts in the use of experiments.
4. Analyze results of equipment in the postflight briefing.

Thomas P. Garmon
9977 Point View Dr.
Jonestone, GA 30236

Project Title: Mission To Summer

Learning does not terminate at the last school bell in June of each year. Young people do not adjourn to educational hibernation through the summer, they simply shift their attention to alternative information input formats.

To most young people, education implies work; work implies an absences of fun, and fun is the very essence of summer. However, it is possible to trespass into summer with an educational agenda covertly because, learning can be fun.

By preparing for and carrying out the activities Thomas has compiled, participants will gain hands-on experiences in basic physics, mathematics, and engineering. They will build and operate the apparatus used to observe scientific principles and quantify their results. Most of the activities can be altered to increase or reduce difficulty. The space-related activities include amusement parks, swimming, cycling, and camping out.

Sample activities include:

Pressure and Volume
Temperature and Pressure
Orbital Rendezvous
Velocity
Doppler Effect
Aerodynamics
Transportation of Volatiles
Energy Management
"G" Induced Stress
Mission Controls

You do not have to wait until summer, the activities can be accomplished during normal classroom time.

Teacher In Space Education Foundation
John G. Wells
VPI & SU
144 Smyth Hall
Blackburg, VA 24061-0254
(703) 231-6480

Project Title: Mission 21

John is one of the nations Teachers In Space participants. He has presented several "hands-on" aerospace-related workshops. John has also worked on several activities targeted for middle school students. For more information concerning his work, please feel free to contact him.

Laura Reeves
119 Granada Hills Ct. N.E.
Albuquerque, NM 87123
(505) 294-2264

Project Title: Team Learning and Problem Solving Using A Space Mission As A Motivator

Laura has developed a workshop scenario for teachers in grades 4–9. The workshops are presented in a series of twelve 1.5 hour sessions (18 hours total).

The two important techniques of team learning and problem solving will be the main thrusts using a future mission to space as a vehicle. Participating teachers develop skills in cooperation, spatial relationships, creativity, decision making, statistical skills, testing strategies, and experimentation.

The goal of the mission is to determine the best lunar site on which to establish a permanent mining base.

Many of her activities were developed by the Challenger Center and Houston Museum of Natural Science.

Larry Scheckel
Tomah Senior High School
Tomah, WI 54660-1855
(608) 372-5986

Project Title: High School Aerospace One Semester Curriculum

Larry has been offering a high school Aerospace Education course at his high school for 18 years. The course is one semester in length and students receive a science credit toward graduation.

The course content deals with aerospace-related careers and job opportunities in aviation. Communicating the knowledge and potential of this fascinating segment of human endeavor, as well as the present impact of air and space vehicles upon society, is one of the goals of the course. Another goal is to apply the academic subjects well using space and flight as central activities.

Curt Olson
Sauk Rapids High School
901 First Street South
Sauk Rapids, MN 56379

Project Title Aerospace Curriculum Activities

The Sauk Rapids High School Technology Department has had a partnership with NASA Lewis Research Center in Cleveland, Ohio, since 1988. The goal of the partnership has been to develop a general secondary education, Aerospace Technology curriculum with emphasis on hands-on activities that reinforce math and science skills. The final program will be made available to all NASA education resource centers throughout the country for use by teachers to incorporate aviation-aerospace in their science or technology curriculum.

The curriculum is designed to be 18 weeks in length with the first nine weeks of class very structured to facilitate an overview of the technical and social aspects of aviation-aerospace.

The second nine weeks students are divided into teams to encourage interpersonal skills. They can choose to become either a NASA Research Center or an Aviation-Aerospace Corporation. They then develop a problem, research it, and build a project that incorporates the work they are doing. Examples of activities include:

1. Wind tunnel development, construction, and testing of various airfoils.
2. Construction of a lunar based model.
3. Radio-controlled airplane or glider construction.
4. Spacelink-computer interface NASA computer.
5. Construction of a space station model.

The students develop a realization of the importance of the future changes in technology, develop problem solving techniques, develop critical thinking skills, and formed interpersonal skills that will allow them to succeed in our future technological society.

Shannon Brown
Echo Shaw Elementary School
Corvallis, OR 97116
(508) 356-6171 Ext. 336

Project Title: Six Weeks in Space
Using NASA's fantastic materials in combination with cross curriculum goals, students spend six weeks in SPACE. The project culminates in a schoolwide space education day. First grade students study buddies countdown in the "van shuttle," while astronauts perform a simulated flight while a HAM radio operator keeps the mission control in contact. Science classes share their findings in aerodynamics, history of flight, etc.

Brad Thode, Instructor
Wood River Junior High
PO Box 1088
Hailey, ID 83333
(208) 888-3523

Project Title: Space Station Simulation
Mr. Thode's students in grades 7–12 use technology to study technology as they designed and built docdecahedron modular space stations 6 feet in length, 9 feet wide and 8 feet tall. Students used computers to design the stations. Computers will also be used as controllers for many of the activities being conducted relating to aerospace flight, bio-technology, communications and production (manufacturing, power/energy and transportation and construction).

Activities will be multidisciplinary allowing students in many subject areas the opportunity to use computers, lasers, fiber optics communications systems and robotics. Using a fiber optic system, students will have 2-way audio and 1-way video communications.

Activities will use a research approach, involving several of the surrounding schools (mission control or research sites) through the use of a phone modem.

This project has been funded mainly by community organizations, with direction and support from his local advisory committee.

Section IV

Industrial Support

Martin Marietta Astronautics Group
℅ Kerry Masson, Public Relations
M/S DC 1020
P.O. Box 179
Denver, CO 80201
(303) 977-5364

Project Title: Educational Support Materials

Martin Marietta publishes education materials for classroom use. The materials are easy to use and follow a color book approach, accompanies with brief scripts that explain the illustrations. **What Are We Up To Now?** is an example of the publication I received upon request for this international survey.

For more information, contact the above address.

Aerospace Industries Association
1250 Eye Stret, N.W.
Washington, D.C. 20005

Project Title: WINNING

WINNING was developed to alert junior high and high school students to the unique career opportunities in America's aerospace industry.

The WINNING video and Facilitator's Guide introduces students to the tools they will need to enter the high tech world of aerospace. It is intended for use in mathematics, science, technology, communications, and English classes. Through discussion and the classroom activities suggested in the guide, you can relate course subjects in your school's curriculum to careers in aerospace.

Ronald C. Hutt, Human Resources/Education
Harris Corporation Headquarters
1025 West NASA Boulevard
Melbone, FL 32919
or
Charles W. Morley Senior Administrator, Marketing Communications
Harris Corporation, Electronic System Sector
P.O. Box 37
Melbone, FL 32902
(407) 727-5689

Project Title: Educational Support

Over the last two fiscal years, Harris Corporation has supported local and regional education with contributions totaling nearly $5 million. These contributions have taken the form of cash grants and scholarships, matching gifts, and in king equipment on both secondary and higher educational levels. Through the U.S.A. Space Foundation, Harris has distributed aerospace coloring books and solar models to Colorado Springs schools. In addition, Harris sponsored an advanced spacecraft model contest for the 28th Space Congress in Cocoa Beach, Florida.

Materials can be made available by contacting one of the above persons.

Educational Insights
Sue Brown, Marketing Comm. Mgr.
19560 S. Rancho Way
Dominguez Hills, CA 90220
(213) 637-2131 or (213) 979-1955
FAX: (213) 60505048
Telex: 140490 ED IN
Toll Free: 1-800-933-3277

Project Title: Elementary Space-Related Educational Materials

EI-5716 Outer Space Adventures
EI-7158 Sky Science
EI-5122 Nature's Greenhouse

Aerospace Educational Development Program
6991 South Madison Way
Littleton, CO 80122

Project Title: Aerospace Handbook

This handbook is an important guide and tool to future education. It accesses a spectrum of subjects and disciplines but focuses them within the aerospace context.

The handbook is an excellent resource guide and provides additional ideas on the implementation of an aerospace-related curriculum, a multidisciplinary approach.

Beech Aircraft Corporation
Aviation Education Dept. 95
9709 East Central
Wichita, KS 67201

Project Title: Aviation Education Programs

Aviation programs are now available from Beech Aircraft Corporation; authoritative, informative aviation materials for classroom use in teaching aviation subjects.

Several of the publications are free; samples include:

- Teacher's Packet, a collection of Beech information and pictures, including additional reference sources.
- Teacher's Syllabus, includes 12 units, each unit includes an introduction, list of discussion questions and text references.
- King Air Packet, descriptions, diagrams, and large display charts on the Beechcraft King Air C90A.
- Starship Packet, aircraft briefing, displays, information materials and descriptions of the Beech Starship.

Other items include a Teacher's Elementary Workbook (cost $10.00) and Aviation Education Series Video. (cost $15.00)

International Science and Engineering Fair Abstracts
E.G. Sherburne, Jr.
Science Services, Inc.
1719 N Street, NW
Washington, D.C. 20036

Project Title: The International Science and Engineering Fair and the "World Series" of Science Fairs

This event is held annually with nearly 700 student contests from affiliated fairs in the United States and several other countries.

The fair is both a competition and an educational experience.

FAA cosponsors provide the top students with special scholarships and awards that recognize young scientists for their excellence in high school science and engineering projects.

Rules, deadlines and formal application may be obtained by writing to the above address or the FAA Aviation Education Program in your local area.

The FAA also sponsors a Young Artist Contest for ages 5–16. The top three art works in each age category (5–8, 9–12, 13–16) receive national awards and compete for international awards.

To request a copy of the FAA Aviation Education Officers in your region, write to:

FAA Headquarters
Phillip S. Woodruff, APA-100
Director of Aviation Education
800 Independence Ave., SW
Office of Public Affairs
Aviation Education Program
Washington, D.C. 20591
or call
(202) 267-3476

INTERNATIONAL TECHNOLOGY EDUCATION ASSOCIATION
1914 Association Drive
Reston, VA 22091